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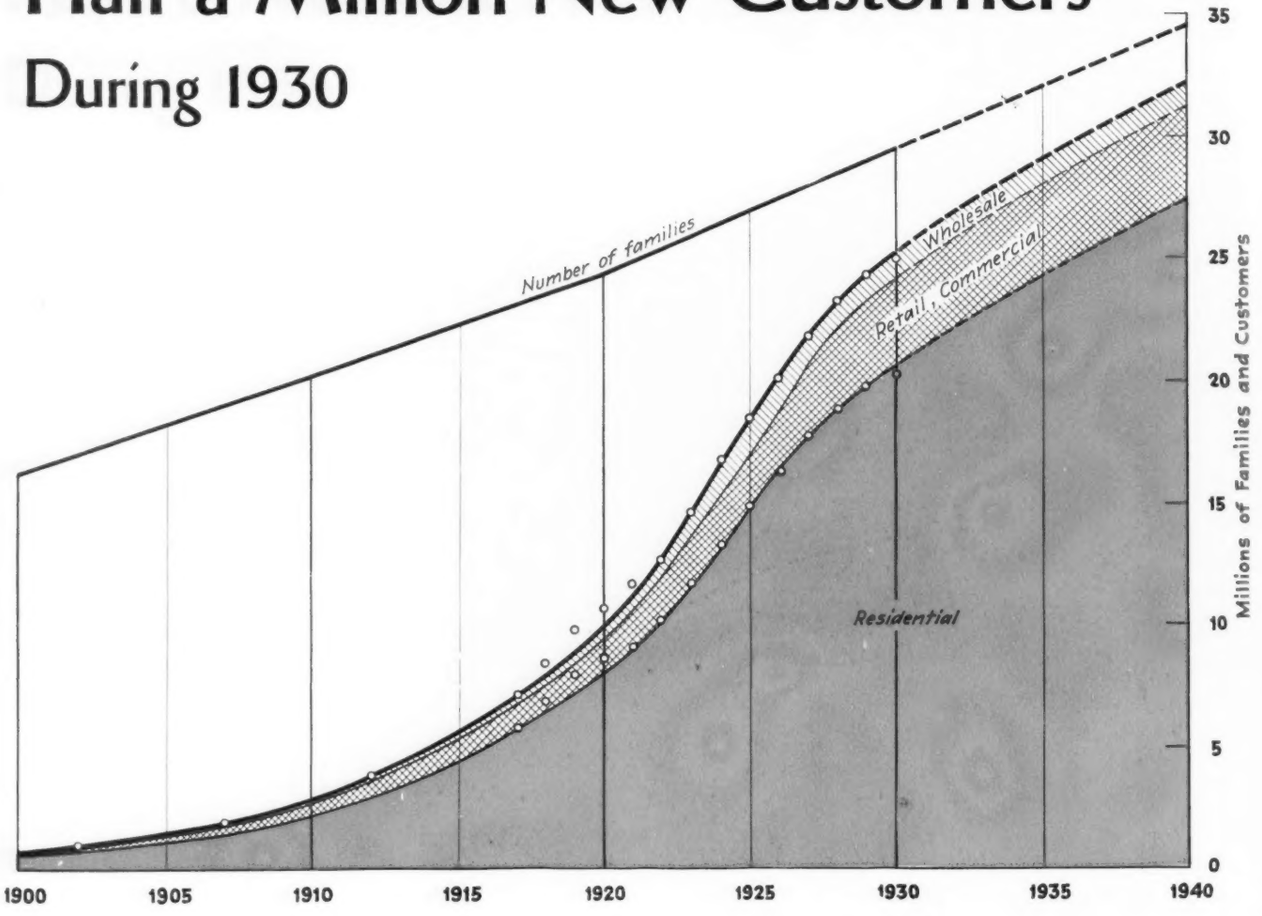

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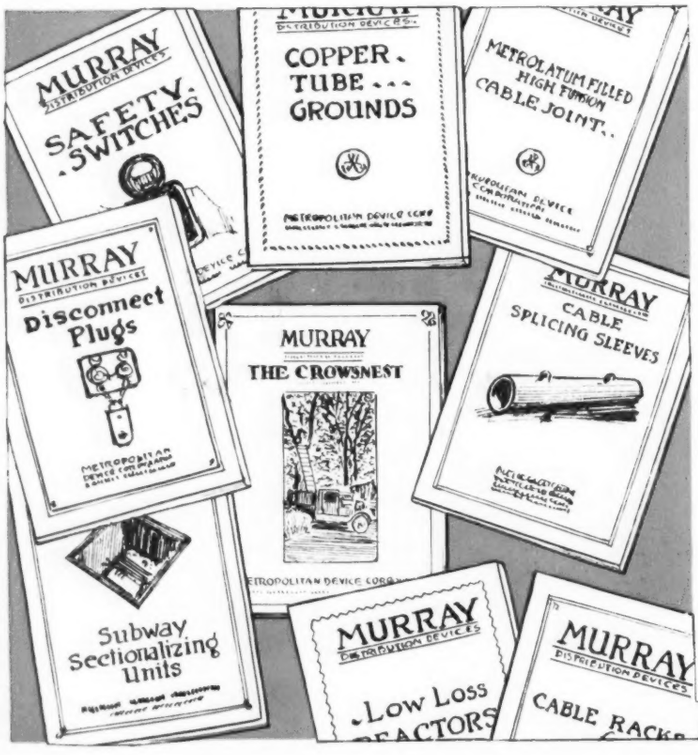
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FEBRUARY 14, 1931

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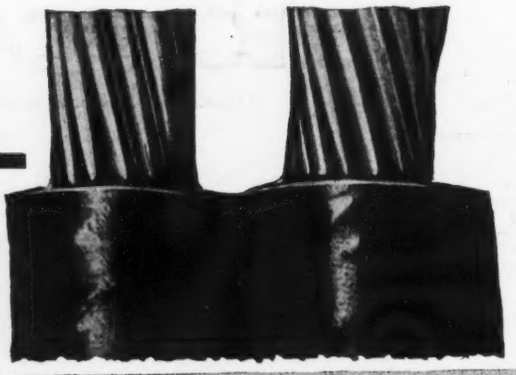

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ELECTRICAL WORLD

for the Week Ending

February 14, 1931

Blank & Stoller

It must soon cease to be possible for any person to say or think honestly that the great blessings of science and engineering are even temporarily a curse to himself or any one else, because of the ways in which they are introduced into industry and business.

ALFRED D. FLINN,
Director
Engineering Foundation

New treaty asked for Niagara River to protect the Falls

Next Trade Commission hearings for New England

—**Tip five city blocks on end** and serve a 7,800-kw. light and power load. That, essentially, is the problem in supplying the 1,250-ft. Empire State Building. Network and radial vertical distribution used—*p. 328.*

—**Electrical industry's future** seen as depending upon group coordination, accurate market data and real salesmanship. The electrified home remains a lovely, luring Lorelei for seekers of sales development—*p. 325.*

—**New England Power group** to be the next subject of Trade Commission investigation. Southeastern hearings closed without any front-page sensations for the newspapers—*p. 303.*

—**Two elevators in one shaft** may soon speed vertical transportation some more. Pioneering installation at Westinghouse plant promises much through increasing available rental areas—*p. 312.*

—**9,500 B.t.u. per kw.-hr. is limit** of best performance to be expected of a steam turbine, A. G. Christie tells Midwest Power Conference. Higher temperatures and pressures and binary cycles to come—*p. 317.*

—**New York's rate case closed** with parting salvos by city and company representatives. Next, briefs will be filed and then the commission's decision will be in order—*p. 305.*

—**Arcs in liquids photographed** with high-speed camera to study successive stages of circuit interruption. Studies with several liquids establish basic phenomena to be encountered—*p. 321.*

—**Farmers want low-cost lines** in New Hampshire and object to those of heavy construction as burdensome on pioneer consumer. Would furnish poles and labor themselves—*p. 306.*

Senators Want New Treaty Concerning Niagara Falls

BECAUSE of the fall of part of the escarpment on the American side of Niagara Falls, the Senate foreign relations committee has decided to take steps toward negotiating a new treaty with Canada solely for the preservation of the beauty of the falls, despite the fact that there has been pending in the committee for two years a treaty already agreed to by Canada which authorizes the diversion of additional water from the Niagara River for power purposes.

This treaty permits the diversion of an additional 20,000 sec.-ft., one-half to be utilized by Canada and the other half by the United States. In return for the additional diversion, the power companies agreed to bear the entire cost of building the submerged weirs which would be necessary to regulate the flow. If a separate treaty were negotiated with Canada and ratified by the two countries, the cost of constructing the remedial works would have to be borne by the two governments. It is estimated that this cost would amount to $1,750,000.

Two factors have tended to retard action in the committee on the present treaty. One factor has been the unwillingness of some of the lake state senators to lose the opportunity of obtaining a trading point with Canada in working out a comprehensive treaty concerning the diversion of boundary waters. In addition, anti-power senators have contended that, even though the power companies would obtain a right to the additional water for a period of only seven years, the use of the water during that period would constitute a moral claim to the continuance of the diversion.

▼

President Lee Answers Governor Pinchot

TWO POINTS ARE BROUGHT OUT in the detailed answer sent, under date of February 7, by President W. S. Lee of the A.I.E.E. to Governor Gifford Pinchot of Pennsylvania in response to the latter's message complaining of the alleged non-existence of data upon distribution costs (ELECTRICAL WORLD, February 7, page 258).

In the first instance, Mr. Lee informs the Governor that a large number of papers and discussions upon distribution engineering have been presented before Institute meetings and published in its *Journal* and *Transactions* and that the Institute has a standing and active committee on power transmission and distribution. He also draws the Governor's attention to the fact that in most states, including Pennsylvania, every light and power company must report upon its distribution-system costs in considerable detail.

Mr. Lee then goes on to explain to the Governor that only such references to costs as "may be appropriate to an understanding of the engineering aspects of particular problems" come within the purview of the Institute as a professional engineering society with definite and limited constitutional functions, implying that the Governor was poorly advised in his selection of a source for information on over-all costs of service and their allocation.

▼

Would Let Washington Handle the St. Lawrence

A POSSIBLE PARTY MOVE to let the federal government become the prime mover in the hydro-electric development of the St. Lawrence River was indicated by a resolution introduced in the New York Legislature this week by Senator W. W. Thayer, chairman committee on public service, who is prominent in Republican ranks at Albany and whose district includes St. Lawrence County, on the international stretch of the river.

Senator Thayer's resolution provides "that the President of the United States be appropriately memorialized to proceed forthwith to a treaty with Canada for the development of the international rapids section of the St. Lawrence River at the earliest possible date and in accordance with the plans agreed upon by the Joint Board of Engineers and submitted to President Coolidge December 27, 1926, or such amendment to or changes in said plans subsequently adopted by such joint board."

Senator Thayer predicted continued delay as the situation now is and declared his constituents demanded action.

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Southeast Inquiry Ends, New England Is Next

WITH A REVERSION to the publicity phase of the inquiry and a statement from holding-company counsel the Federal Trade Commission's investigation of Southeastern power and light companies came to an end on February 5 and 6, and the hearings were adjourned until February 25, when the affairs of the New England Power Company and the New England Power Association will be discussed.

Judge Healy examined W. J. Baldwin, former director of publicity for the Alabama Power Company. Mr. Baldwin admitted that newspapers con-

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SECOND DAM ON SKOKOMISH NEARLY FINISHED

When the spillway section of this 240-ft.-high dam is finished next month Cushman plant No. 2, part of Tacoma's municipal system, will advance another step. One 37,500-hp. Allis-Chalmers unit went into service in January and a second will go in in the spring. Eventually there will be four.

sidered "fair" in their treatment of public utilities received a preference in placing advertising as compared with "unfair" newspapers. No advertising, for instance, was placed in the Thompson chain of papers.

Publicity regarding the associated Southern power companies' bid for Muscle Shoals was gone into. In this matter Mr. Baldwin collaborated with C. A. Beasley, attorney for the Commonwealth & Southern Corporation. The examination brought out that Mr. Beasley had conferred with representatives of the committees maintained by the power companies in several states tributary to Muscle Shoals in which he explained the advantages of the offer of the associated companies. He admitted having conferred personally with the editors of several Southern newspapers. He denied that he had made any payment to the Washington correspondent of any publication.

▼

Power and Regulation in State Legislatures

CALIFORNIA.—A bill has been introduced in the House to amend the state constitution so as to require the taxation of publicly owned utilities. A Senate bill would prohibit expenditure of funds by public utilities "in political campaigns or for propaganda purposes." Political purposes are defined in the bill as "the influencing or attempting to influence the vote for or against any candidate for public office, or influencing or inducing any person to become or not to become a candidate for public office, or influencing or attempting to influence the vote for or against any measure on the ballot at either state or local elections, or endeavoring to have any measure placed upon or kept off of such ballot."

COLORADO.—Western utility officials are focusing attention on a "utility district" bill, scheduled for introduction at the present session. This proposed measure would authorize county commissioners, on petition of 10 per cent of the voters in any community, to submit at a general election a proposal to set up a "public utility district" in the nature of a municipal corporation controlled by a three-man commission elected for a three-year term. This body would not be responsible to the Colorado Public Utilities Commission and would have as a check on its activities only a referendum vote of taxpayers in the district. The bill permits a utility district to acquire any utility by a majority vote and "funds for such acquisition would be contracted for by bonds with a limit fixed at 1 per cent of assessed valuation of the district." A bitter fight over this bill is predicted, with party lines broken.

INDIANA.—A bill has been introduced in the House which would eliminate the jurisdiction of the Public Service Commission over light, water, power and heat companies after July 1. By 27 to 9 the Senate last week advanced to second reading, without amendment, the Moorhead bill to bring utility holding companies under the jurisdiction of the Public Service Commission.

MASSACHUSETTS.—A proposal to memorialize Congress "in favor of restoring to the states the right to regulate and control local public utilities" has been offered in the House by a Boston representative who finds that Massachusetts' established method of regulation and control is threatened by the existing right to seek in the federal courts injunctions restraining the enforcement of the orders of its Department of Public Utilities.

MINNESOTA.—Minnesota municipalities operating electric plants would have the right to extend their service outside the city limits under the terms of a law suggested to the Legislature by the League of Minnesota Municipalities. A law now on the books permits cities and villages to sell "surplus" energy outside their limits.

MISSOURI.—The Public Service Commission would lose control over public utilities in St. Louis, Kansas City and St. Joseph under provisions of a bill introduced in the House by Assemblyman Jones. The measure, which would apply to cities over 70,000, would return to such municipalities the right to control the public utilities, grant franchises and stipulate the rates to be charged. Mr. Jones also introduced a bill to raise taxes on all utilities. Another bill introduced in both Houses would tax the Union Electric Light & Power Company for public purposes in the four counties where land has been inundated by building Bagnell Dam.

NEBRASKA.—With the bar up on introduction of further bills, those on the calendar which affect public utilities include measures providing that irrigation districts may own, operate and control hydro-electric projects and may sell or lease plants to persons, corporations or municipalities, using revenue to reduce costs of irrigation; making unlawful the manufacturing, leasing, distributing and selling of merchandise by public utilities except those owned by the company in manufacturing and selling service or those articles which are the direct product of the business of manufacturing or selling service, with penalties ranging from $100 to $500 for each such sale (asked for by state Hardware Dealers' Association), and authorizing the creation of hydro-electric power districts by incorporated cities and villages and also by rural units, to be operated jointly or singly, with provisions for organization, administration and territorial areas to be served.

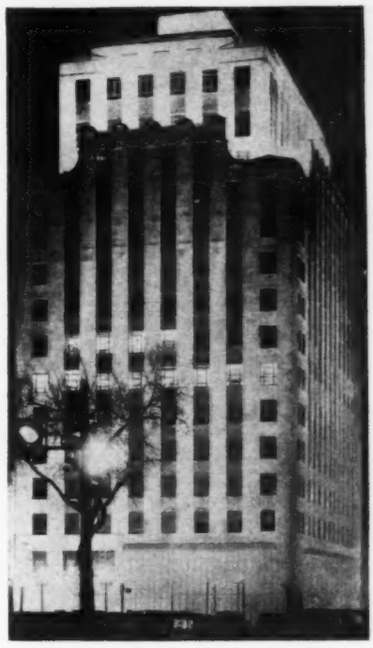
Pinchotian Accuracy

J. P. Morgan, Dominating Electric Bond & Share, Controls Oregon Politics Through Mythical Portland Company

All the great utilities, without exception, known to me have interests which cross state boundaries, and many of them are nation-wide. For example, the firm of J. P. Morgan & Company in New York has so many affiliated electric interests that it controls, I am informed, more than half the electricity produced in America.

Take the following illustration: The politics of Oregon has been controlled largely by the Portland Electric Light Company. That company is an Electric Bond & Share concern. The Electric Bond & Share is a Morgan concern. There you have a direct line from Wall Street to the controlling political interests of Oregon, 3,000 miles away.—*Governor Pinchot to United Press.*

WHERE LINCOLN WALKED



The Central Illinois Public Service Company's new office building at Springfield is floodlighted in red, amber, blue and white by 251 "Golden Glow" projectors installed above the thirteenth floor and by 30 1,000-watt "Golden Glow" floodlamps on the curb line.

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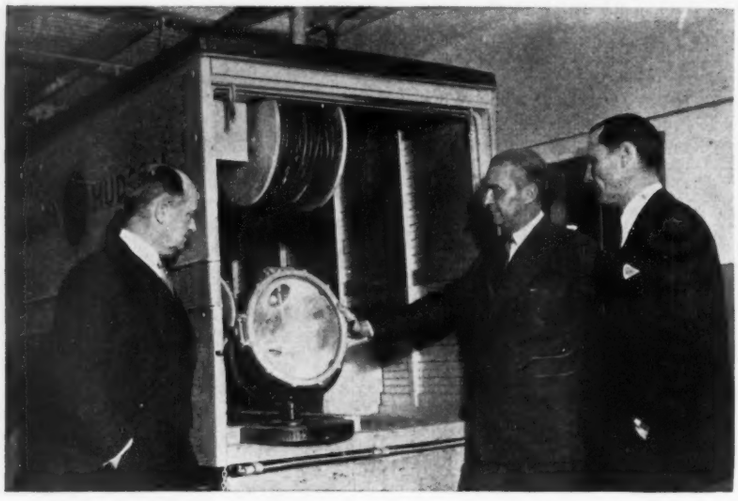
NIAGARA-HUDSON MEN VIEW EMERGENCY TRUCK



With Vice-President William Kelly on his right and Vice-President A. H. Schoellkopf on his left, President Paul A. Schoellkopf of the Niagara-Hudson Power Corporation is here seen examining an emergency illumination truck that carries a small chain-driven generator to charge four 1,500- and two 1,000-watt floodlighting units.

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The last bill is similar to bills enacted at three previous sessions and declared unconstitutional.

NEW YORK.—By an Assembly bill the public service law is amended by empowering the commission to order the relocation of electrical transmission lines within 1,000 ft. of an established airport. A bill introduced by Senator Thayer, chairman of the committee on public service, adds a section to the public service law giving the commission authority over all charges to operating expense accounts of utility companies for the creation of reserves and offsetting credits thereto. A second Thayer bill adds a section to the public service law providing that a utility corporation shall not credit part of proceeds of its non-par stock to capital and part to surplus nor transfer any part of its stated capital to surplus.

OREGON.—Franklin T. Griffith, president of the Portland General Electric Company, has told the utilities committee of the Legislature that the adoption of the proposed Hydro-Electric Commission bill, with the attending water conservation provisions, will, in his opinion, result in the immediate cessation of the development of the state's water-power resources by private companies. Officials representing the California - Oregon Power Company took a similar attitude. Asserting that their only protection against encroachment and possible absorption by large corporations is the application of the certificate of convenience and necessity, a delegation representing small electric and telephone utilities operating in Oregon appeared before a legislative committee and asked that the certificate be retained in the regulatory code of the state. A bill providing for its abolition, as advocated by Governor Meier, is before the Legislature.

PENNSYLVANIA.—Governor Pinchot's victory in the Lower House last week when the Moore resolution to investigate the Public Service Commission was passed by 121 to 70 was counterbalanced on Monday last by a victory of his opponents in the Senate, when by 30 to 20 the Earnest resolution was recommitted. The Earnest resolution, as explained previously, called for an investigation by the joint judiciary committees of the two houses; the Moore resolution for an investigation by three senators, three representatives and three appointees of the Governor. Subsequently the Senate, without a record vote, passed the second Earnest resolution, providing that the investigation shall be conducted by a subcommittee of the Senate judiciary committee, thus shutting out the House and the Governor. Mr. Pinchot, while declaring that this disposition of the matter is intended to "whitewash the utilities," asked his champions in the Senate not to oppose it and said he would appear before the investigators if asked. He recommended an independent House investigation.

TEXAS.—State ownership and operation of all the larger electric generating plants and transmission systems in Texas are proposed in a joint resolution in the nature of an amendment to the constitution which if adopted by the voters would authorize the state to issue bonds for the purchase of the power plants and transmission lines. Senator Cunningham, the sponsor, cites Ontario as his inspiration.

VERMONT.—A bill is before the Vermont Legislature which would give the Public Service Commission more power. At a first hearing the bill was bitterly opposed by Representative Burke of Burlington, who attacked the commission for approving a rate schedule of the Green Mountain Power Company which, Mr. Burke said, was opposed in a petition from 2,000 persons. It was further charged that an advisory engineer for the commission had received $450,000 in fees in four years. The bill was returned to the committee.

WISCONSIN.—The Railroad Commission has completed a preliminary report to the Legislature on a study of the costs of furnishing electric service as they affect the spread in rates between various classes of consumers. The commission also, pursuant to a resolution of the 1929 Legislature, is investigating the matter of uniformity in the rate schedules for electric light, heat and power, and a report will be made on this subject later in the present session. The commission has found that "the domestic customer with an annual consumption of between 500 kw.-hr. and 1,000 kw.-hr. is paying slightly less than the cost of serving him, while those with consumptions of 1,200 kw.-hr. per year or over are paying somewhat more."

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Will Test Smith's Right to Sit on Power Board

SENATOR WALSH'S MOTION directing the United States attorney for the District of Columbia—Leo A. Rover—to institute *quo warranto* proceedings for the removal from office of Chairman George Otis Smith of the Federal Power Commission passed the Upper House on February 5 without a debate or division, and Attorney-General Mitchell, whose subordinate Mr. Rover is and whose advice the President asked in refusing to resubmit Mr. Smith's name, has stated that no obstacles will be thrown in the way of determination in this manner of Mr. Smith's right to hold his office. (ELECTRICAL WORLD, February 7, page 259.) Special counsel, however, will be named, to represent both the Senate and the Department of Justice, the latter acting only nominally as the bringer of the proceedings.

Seattle Plans to Build a 230-Kv., 125-Mile Line

A 230-KV. TRANSMISSION LINE will be built by the city of Seattle, according to announcement by the engineers for the municipal lighting department. The line, which will be approximately 125 miles long, will extend from the Diablo plant of the Skagit River power development project to the south substation in Seattle. Initial plans contemplated operation at 165 kv.

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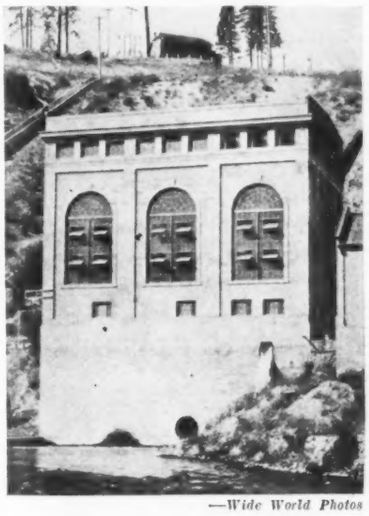
Dynamiting Farmer Wins Against Pacific G. & E.

THREE DECISIONS have been rendered by the Superior Court of Shasta County, California, in the litigation arising from the dynamiting last November of the Pacific Gas & Electric Company's Hat Creek dam by Louis P. Joerger, a farmer who claimed that the power company was illegally diverting water from his riparian land on Hat Creek. The company secured an injunction forbidding Mr. Joerger from further molesting



—*Wide World Photos*

Hat Creek hydro plant

the dam, and in return Joerger applied for an injunction to restrain the company from interfering with the water in Hat Creek. The power company also brought suit against Joerger for $9,367 to cover the damages to the dam. The decisions just rendered dissolve the injunction against Joerger, grant to him an injunction which restrains the power company temporarily from interfering in any way with the Hat Creek waters, and reject the company's claims for damages. Under the injunction granted Mr. Joerger, the Hat Creek power plant may be shut down temporarily. The case will be carried to the higher courts.

Some time previous to the dynamiting a partial judgment of $40,000 had been awarded to Mr. Joerger in settlement of some of his claims for water rights.

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Power Board Matters— Old Projects and New

FOR MEETING THE EXPENSES of the Federal Power Commission during the next fiscal year $260,195 is provided in the independent offices appropriation bill. The 1932 estimates are based on the assumption that the engineering services of the Departments of War, Interior and Agriculture will continue to perform the field work of the commission. The appropriation includes the salaries of the five commissioners at $10,000 each.

A public hearing on the application of the Appalachian Electric Power Company for a license to develop power on the New River, Va., will be held before the commission February 16. Notice of the hearing was sent to the Governors of Virginia, West Virginia, Tennessee and Arkansas, who have indicated interest in the proposed project, one involving important principles.

Application has been made by the Commonwealth Mining & Exploring Company of Seattle to the Federal Power Commission for a license covering a project on the Davis River in the Tongass National Forest in Alaska, for which the company obtained a preliminary permit October 5, 1929. It is proposed to construct a concrete dam 2,000 ft. above tidewater to form a reservoir 5 miles long. A tunnel 1,600 ft. long will carry the water to the power house on the shore of Portland Canal. While the primary capacity is thought not to exceed 5,300 hp., it is planned to install 25,000 hp. A further alternate development is planned which will make it possible to install 50,000 hp. The power is to be used for mining purposes and for utility use in the towns of Hyder and Stewart.

The city of Idaho Falls, Idaho, has applied for a preliminary permit covering a proposed two-dam, 1,900-hp. development on the North Fork of the Snake River above Mesa Falls, in that state.

The Arkansas-Missouri Power Company of Bytheville, Ark., has filed a declaration of intention to rebuild Dam No. 2 in Spring River, Fulton County, recently destroyed by high water. It also is planned to construct a new dam to be known as Dam No. 4. Installations of 650 hp. and 2,500 hp. respectively are involved.

Commissioner Williamson has been elected vice-chairman of the commission.

Applying Ultraviolet Rays to the Food Industry

LABORATORIES ARE BEING set up at the University of Cincinnati for the application to food of a new process, to be known as "selective irradiation," discovered by Prof. George Sperti of the university as the result of breaking down ultraviolet rays and determining

George Sperti

their specific characteristics. Professor Sperti discovered that there is a critical wave length at which biological and other reactions begin which effect changes in the taste, smell, consistency, etc., of food, but that wave lengths considerably shorter result in the destruction of bacteria, formation of vitamin D, for instance, starting at a wave length of about 3,100 angstrom units.

Striking applications of this discovery have followed. For example, milk can be irradiated under the new process without affecting its smell, taste or color, while its vitamin D content is increased. Orange juice can be treated after extraction so that it retains its original flavor for indefinite periods. Fermentation, yeast molds and various forms of food spoilage are checked. Refrigeration is not required as an auxiliary aid to these results.

Ralph G. Coburn, now executive vice-president of General Foods Corporation, will head the laboratories, set up jointly by that company and the university.

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N. Y. Edison Rate Case Hearings Terminate

SOMEWHAT HEATED ARGUMENTS between Clarence J. Shearn, legal representative of the New York Real Estate Board, and William L. Ransom, counsel for the New York Edison and its af-

filiated companies, brought to a close on February 7 the rate hearings of the New York Public Service Commission on the new tariff proposed by President M. S. Sloan.

Mr. Shearn thought "pure hokum" the right term for the company's offer on account of the meter charge that makes part of it and said that the net decrease to residential consumers would be only $1,900,000 and the saving to commercial users "problematical" because of load-factor conditions. Mr. Ransom said that in the reduction of the energy rate from 7 to 5 cents the companies would lose $26,000,000 and that $15,000,000 would accrue to the utilities through the 60-cent service charge and $5,000,000 through the demand charge of $1, making a net reduction of $6,000,000. He said no constructive suggestions for revision of the company's plan had been received.

Briefs are to be submitted by February 21.

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New Hampshire Farmers Want Inexpensive Lines

A RECENT HEARING before the New Hampshire Public Service Commission on rural service brought forth a protest from George Putnam, president New Hampshire Farm Bureau Federation, against farmers being asked to pay for "fancy" power lines "planned to last forever," when lines strung on 25-ft. poles and with wires merely heavy enough for present needs would be acceptable to them. He contended that it was unfair to force small customers to shoulder the expense of installations designed to be adequate for the enlarged demands and services of a future period. The State Commissioner of Agriculture upheld this point of view and suggested that farmers could lessen the cost of the lines to themselves if they were permitted to furnish the poles and do the labor. Views of utility companies will be presented at a later hearing.

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New Hampshire Domestic Rates Called Too High

HOLDING THAT industrial companies in New Hampshire use 23.47 per cent of the total energy consumed in that state but contribute only 21.51 per cent of light and power revenues, whereas domestic customers consume only 6.82 per cent and contribute 27.52 per cent, Samuel H. Mildram, a Boston engineer, has made a report to the New Hampshire Public Service Commission in which he recommends:

1. A general reduction in residential lighting rates by electric utilities.
2. Scrapping of existing complicated "room-rate" and "area-rate" schedules for domestic users of electricity.
3. Promulgation of a "simple and understandable" standard rate schedule for domestic users which would permit use of a single meter for all purposes.
4. Adoption of a standard rural electrification policy which would discard the present practice of charging line construction costs to the rural customer and substitute an "excess line charge" sufficient to pay the carrying charges of company investment in rural line.
5. A simpler system for rate charges to summer residents.

Mr. Mildram's investigation covers financial features also.

Drought Conditions Affect Generation in Colorado

AN UNUSUAL BURDEN has fallen on steam-electric generating plants in Colorado this year, with prospect of becoming more onerous yet, owing to drought. Clare N. Stannard, vice-president and general manager of the Public Service Company of Colorado, points out, however, that additional facilities at the Valmont steam plant, near Boulder, have been completed opportunely.

At Shoshone, on the Colorado, in the western part of the state, the company's hydro-plant output during January was 62 per cent of normal. The Boulder hydro station, on Middle Boulder Creek, on the eastern slope of the Rocky Mountains, produced 72 per cent of normal. At Estes Park, where Fall River has been at its lowest stage in years, the hydro plant has almost ceased operations, and an auxiliary oil engine was resorted to early in February. At Longmont the municipally owned hydro station on the St. Vrain River has been operating at reduced capacity for some time, and the community has been purchasing most of its power requirements from the Public Service company, pending installation of an oil engine. The Loveland municipal plant, on the Big Thompson, has been dependent on oil-burning equipment.

Precipitation in Denver and vicinity for January was 0.02 in., whereas 0.48 is normal—a fair criterion of conditions throughout Colorado, where snowfall has been practically nil. Although the Public Service Company is fully equipped to handle all demands upon it, Mr. Stannard insists that future expansion must be largely in steam equipment.

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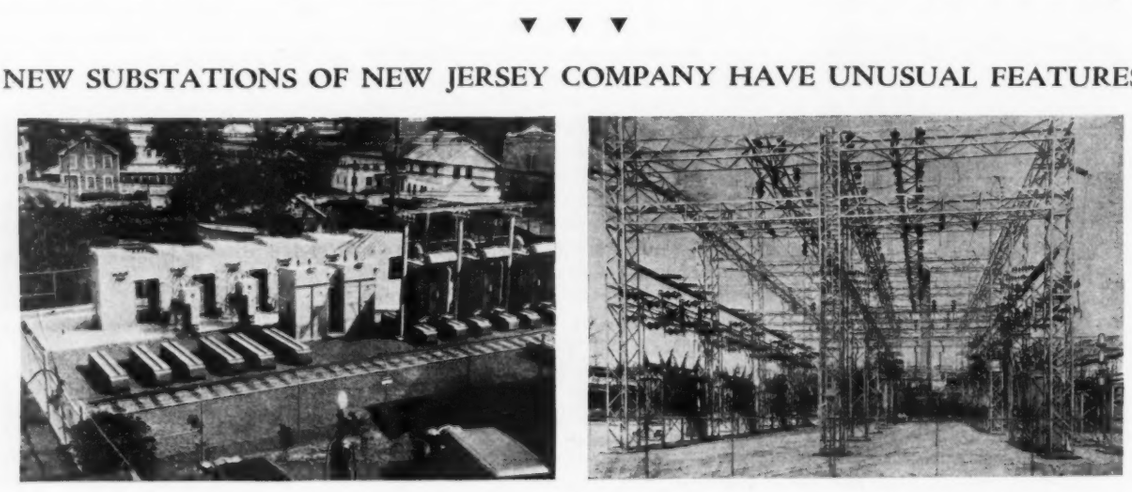
NEW SUBSTATIONS OF NEW JERSEY COMPANY HAVE UNUSUAL FEATURES



The Millburn substation of the Jersey Central Power & Light Company (on the left) contains no structural steelwork anywhere except three posts carrying the wires to the transformers. Operation of any switch is recorded two blocks away, an instrument showing time and duration of every outage. At the Chatham substation (on the right) three ground wires are carried all the way across the structure as protection against lightning. Thyrite arresters are used. Impact voltage is unusually high to prevent lightning entering the station and flashing over. Air-break switches largely replace circuit breakers for switching.

Scattered Happenings in the Electrical Sphere

United States

OFFICIAL ANNOUNCEMENT is made that the committee of the Engineering National Section, N.E.L.A., which deals with co-ordinative measures with telephone and telegraph systems is henceforth to be called the foreign systems co-ordination committee instead of the inductive co-ordination committee. M. D. Hooven is the committee chairman.

ACCORDING TO PHILADELPHIA newspapers, the Lehigh Coal & Navigation Company is preparing to re-enter the power business by erecting a combination steam and hydro generating plant on the Lehigh River in the coal-mining district of Pennsylvania. Officials would neither deny nor confirm the report. The Lehigh company's former electric properties were merged in 1920 into the Pennsylvania Power & Light Company.

A CAMPAIGN AGAINST the rates of the Westchester Lighting Company has been started at New Rochelle, N. Y. Robert C. Gillies, "utilities specialist," told a meeting, the press reports, that the company's primary rate of 9½ cents a kilowatt-hour for 10 kw.-hr. was higher than that for any similar area in the country.

THE UNITED STATES DISTRICT COURT at St. Paul has refused to authorize sale of the W. B. Foshay company hydro-electric plant at Polson, Mont., for $137,500 to the United States Bureau of Indian Affairs, suggesting that the receiver renew negotiations with the Indian office to try to get a better price.

REVIEW OF A TEST CASE brought against the city of Philadelphia by the Philadelphia Electric Company for a determination of its rights to compensation because of the compelled removal of conduits to make way for the city-constructed Broad Street subway has been asked of the United States Supreme Court.

THE DISPUTE OVER DIVISION of Delaware River water between New York, New Jersey and Pennsylvania, inherent in which are certain issues involving water power and which after a failure to agree on legislation was submitted last year to C. M. Burch, special master, has now been the subject of a report by him in which an average allotment of 440,000,000 gal. a day to New York City is recommended instead of the 600,000,000 gal. asked. Both New York and New Jersey are expected to file exceptions to the report.

RATES FILED WITH THE California Railroad Commission some weeks ago by the Southern California Edison Company covered six optional schedules and indicated a total annual saving to customers of $775,000 due to lower agricultural and industrial rates and the introduction of a power-factor clause in the wholesale tariffs. Two additional optional schedules have just been filed covering lighting and power service to manufacturing firms. These, it is estimated, will bring an additional saving of $300,000 a year.

THE COLUMBIA VALLEY POWER COMPANY has offered to sell the city of Portland, Ore., 53,000 hp. at $15.50 per horsepower-year or more than that quantity at prices not to exceed $15 per horsepower-year and to deliver this power to city limits within eighteen months. This company owns the Pelton and Metolius sites on the Deschutes River, capable of combined development to about 180,000 hp. The sites are about 90 miles southeast of Portland.

THE WISCONSIN RAILROAD COMMISSION has under advisement an application by the Wisconsin Public Service Corporation for permission to consolidate with it the Wisconsin Valley Electric, Wisconsin Valley Power, Waupaca Electric Service & Railway and Valley Transit companies, all controlled by the Byllesby corporation.

BAGNELL DAM in Missouri will probably be finished this month and the water start to fill what the Union Electric Light & Power Company of St. Louis has christened the "Lake of the Ozarks." It is hoped to start up the turbines on July 4.

A PLAN TO RECAPTURE water after it has gone through the Dix River hydro plant by pumping it from the pool below the dam back into the lake by means of motor-driven centrifugal pumps of great size is understood to be in contemplation by the Kentucky Utilities Company. The scheme, if carried out, would be for off-load periods and dry-weather conditions.

Canada

THROWING OF A SWITCH in the Saskatoon power house of the Saskatchewan Power Commission recently energized a new high-tension power line to Shell Brook, 120 miles to the northeast. This undertaking will be followed rapidly by the inauguration of several similar lines which the commission has erected. In all about 400 miles of line will be functioning soon, and 100 towns will be served.

INTEREST HAS BEEN REVIVED in the proposed power development project at Carillon, on the Ottawa River, about half-way between Ottawa and Montreal. It is now stated that the Shawinigan Water & Power Company is prepared to proceed with a scheme which will produce a maximum of 600,000 hp. at that point, a development almost identical in magnitude with that of the Beauharnois company on the St. Lawrence.

THE CHATS FALLS POWER COMPANY of Quebec, which is building jointly with the Ontario Hydro-Electric Power Commission a 224,000-hp. hydro plant on the Ottawa River, is now known as the Ottawa Valley Power Company.

Abroad

POPE PIUS XI on February 6 personally started the Vatican's new 800-hp. Diesel-engine power station, which replaces one that had become insufficient for the increased needs of the Vatican since it became an independent state.

AN IMPORTANT STAGE has just been reached in the development of the Southeast England regional electric scheme through the laying of the concrete foundation for the main substation opposite the Barking generating station, the key power house. It is thought that the substation will be in operation this year. A new 150,000-kw. unit will bring the capacity of the station up to 390,000 kw. Eventually it will be one of the largest in the world.

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Coming Meetings

Engineering National Section, N.E.L.A.—Group meeting, New Jefferson Hotel, St. Louis, Feb. 16-19. A. J. Marshall, 420 Lexington Ave., New York.

Public Utility Group, National Association of Purchasing Agents—Statler Hotel, Boston, Feb. 19 and 20. G. A. Renard, 11 Park Place, New York.

North Central Division, N.E.L.A.—Engineering meeting, Minneapolis, Feb. 23 and 24. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Electrical Advertising Conference—Westinghouse Lighting Institute, New York, Feb. 25-27. E. A. Mills, New York Edison Co., New York.

American Institute of Electrical Engineers—District meetings, Pittsburgh, March 9-13; Rochester, April 29-May 2. F. L. Hutchinson, 33 W. 39th St., New York.

Oklahoma Utilities Association—Oklahoma City, March 10-12. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Springfield, Ill., March 12 and 13. G. W. Schwaner, 205 Illinois Mine Workers Bldg., Springfield, Ill.

Northwest Electric Light and Power Association—Commercial Section, Spokane, Wash., March 16-18; Engineering Section, Wenatchee, Wash., March 18-20; Accounting Section, Salt Lake City, April 13 and 14. B. Snow, 1208 Spalding Bldg., Portland, Ore.

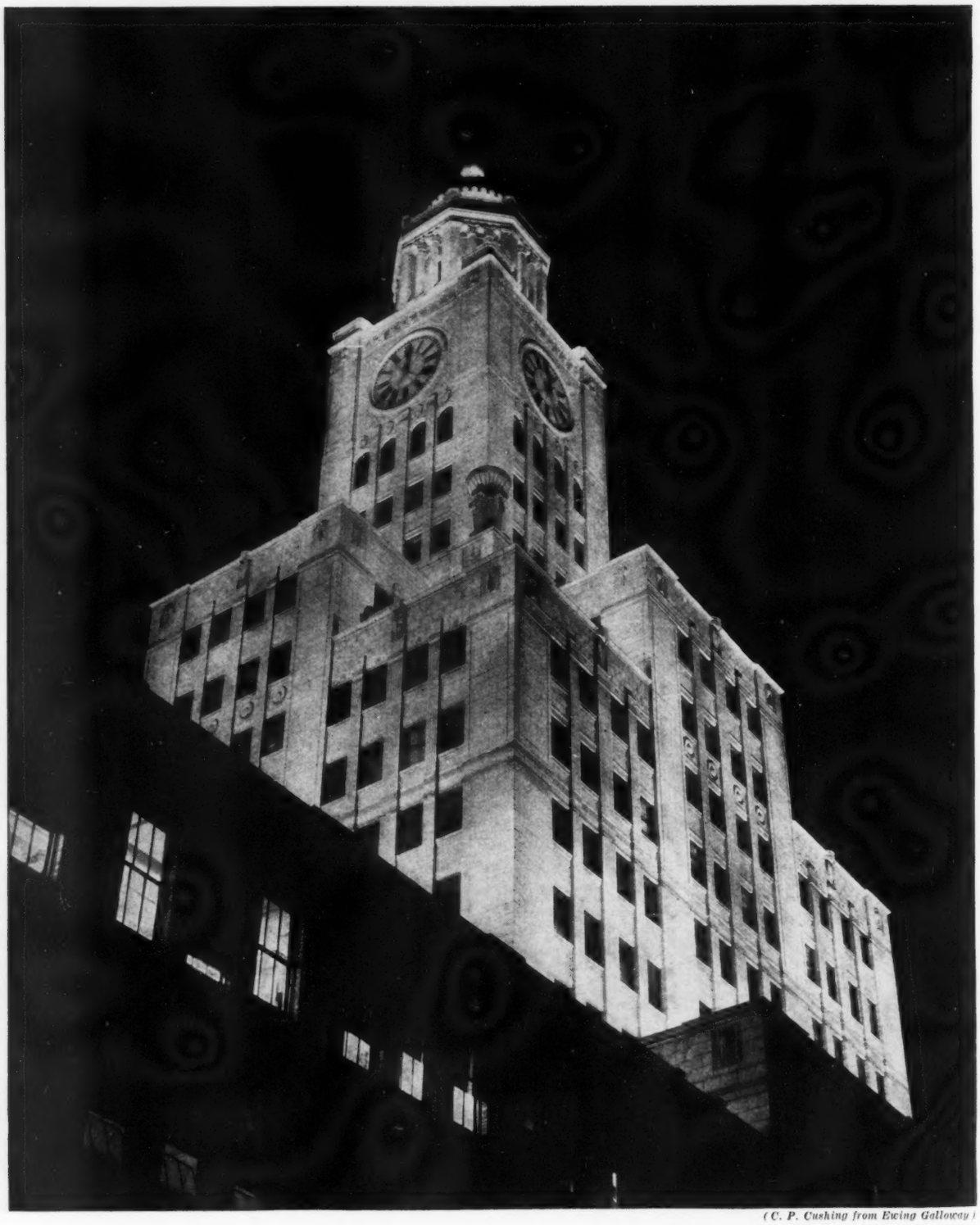
Southeastern Division, N.E.L.A.—Vinoy Park Hotel, St. Petersburg, Fla., April 1-3. C. M. Kilian, 508 Haas-Howell Bldg., Atlanta, Ga.

Maryland Utilities Association—Lord Baltimore Hotel, Baltimore, April 10. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 16-18. F. D. Beardslee, 315 N. 12th St., St. Louis.

Southwestern Geographic Division, N.E.L.A.—Mineral Wells, Tex., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Electrochemical Society—Hotel Tutwiler, Birmingham, Ala., April 23-25. C. G. Fink, Columbia University, New York.



(C. P. Cushing from Ewing Galloway)

Out of the night the white tower of the Elverson Building in Philadelphia, floodlighted in startling brilliance, brings a distinctly modern touch to the rapidly changing skyline of that city. Notable from the technical standpoint is the even distribution of light over the illuminated surface

EDITORIALS

L.W.W.MORROW
Editor

Oregon Governor would tax municipal utilities

OREGON has acquired a most unusual governor. Elected by a large majority with the power issue the center of the fight, and sponsoring public ownership of utilities, he now advocates that municipal power ventures be taxed. His reasons for supporting such taxation are amazing in view of his attitude on government ownership. Governor Meier says that loss of tax revenue is one of the chief arguments of opponents to extension of municipal utilities. Destroy the argument by abolishing exemption and opposition to public ownership is weakened. Further, it is his contention that by paying taxes municipalities would be passing along to the whole commonwealth some of the "blessings" they enjoy.

Regardless of the Governor's reasoning, his conclusion that municipal utilities should be taxed is right. Not only should they be taxed but they should be commission-controlled and operate under the same accounting system as private utilities, thus making fair comparisons possible.

Aside from that, the Governor has missed the whole significance of the situation. The unanswerable, final stumbling block which every public ownership advocate must surmount is the challenge to show that any public undertaking in the United States has ever been over any sustained period of time a technical, financial, economic, efficient and progressive success—something which in every respect the private conduct of the utility business has been. The prospect of lower rates through municipal and governmental developments is the most elusive and illusory of phantoms.

Governor Meier's idea of the reasons for opposition to political ownership overlook the real issue. Bureaucracy, red tape, favoritism, political and party obligations, graft, lack of incentive to accomplishment and the widespread breakdown of our elective system are the factors which prevent and will continue to prevent any major moves toward government ownership.

Maintain wages and speed recovery

FAR-SIGHTED business men recognize the necessity of maintaining wages and employment so that sustained purchasing power will help speed business recovery. But some financiers and bankers who have become accustomed to looking only at balance sheets and the immediate savings effected by a reduction of labor costs apparently need their eyes opened to the sources of purchasing power.

The following comment by John E. Rovensky, vice-chairman of the Bank of America, states in a few words a fact that any logically minded man should immediately recognize: "Many believe that wage reductions are part of the solution. I doubt it. It is difficult to reconcile the statement that we have overproduction with the contention that reducing the purchasing power of millions is desirable."

In a period of depression mass psychology is singularly susceptible to stampeding. Every individual case involving reduction of wages or the loss of employment tends to have a restraining influence on the buying activities not of one individual or family but of a circle of friends and acquaintances of the unfortunate one as well. The decline in buying is much wider than the actual loss in buying power.

This fact accentuates the economic folly of

"pay-roll cutting" apart entirely from purely humanitarian considerations. It is evident that this short-sighted and ill-advised policy not only defeats its own purpose but goes even beyond in the direction of drying up much of the purchasing power of the nation at its very source. Calm, deliberate judgment condemns the policy in most emphatic terms even from a purely business viewpoint.

Low-cost power plants

FUEL economies that may be obtained by the use of the various steam cycles are now quite generally known, and little improvement in these cycles can reasonably be expected in the near future. Possibilities of higher steam pressures and temperatures and of the various combinations of reheating and bleeding for feed-water heating have been thoroughly studied. Many of these have been tried in commercial plants. The fuel economies indicated by these advanced cycles cannot always govern the design of a new station, since the first cost of plant to obtain such results is often so high as to offset the resultant savings. At the present moment attention is centered on the first cost of stations and on all possible means of reducing this investment.

A survey of the possibilities of steam turbines indicates that lower costs per unit of capacity may only be obtained through the use of large units. When load conditions fix the maximum size of turbine permissible in a given station, they also fix in a considerable degree the cost of the turbine and of the turbine room as well. Floor space required by units of a given rating may be reduced slightly by redesign, but the savings in turbine-room cost will not be large. Small savings too, are all that can be effected in the design of the condenser and its auxiliaries. Costs of electrical equipment have tended to increase owing to the use of more and better switching and protective devices. Designers can do little to reduce these costs without sacrificing valuable features. Coal- and ash-handling equipment presents individual problems in every plant. Skillful design often saves money on this equipment, but this will not be a large item in the total plant cost. Cost reductions in the turbine room are not promising.

The greatest savings in first cost can apparently be made in the boiler plant. Dr. Frederick Munzinger, the leading authority on boilers in Europe, recently said: "The construction of boilers of very high capacities is the most effective means existing today for achieving reduction in the cost of plant and in the cost of generation."

This definite expression of opinion deserves careful consideration, by American engineers particularly, since it has been verified by remarkably high outputs by certain of the modern boilers installed in this country. It is now apparent that the possible steaming capacity of a given amount of boiler heating surface is fixed only by the amount of fuel that can be economically burned under it in a properly proportioned furnace. Old ratings of boilers must go into the discard.

Under present-day conditions the use of large boilers with ample furnaces, designed to be operated at high ratings—much higher even than present-day practice—together with suitable heat-recovery equipment in the form of economizers or air preheaters, offers the best possibility for reducing the initial investment in power plants.

The inadequacy of power-company selling

NOTHING better illustrates the inadequacy of the present scale of power-company load building than the prevalent policy toward selling domestic appliances of small consumption. Theoretically all chief executives want to build up residence load. Theoretically all sales managers want to get complete household equipment into universal use. But as a matter of fact their real interest is at present centered on refrigeration and in some cities on ranges. That's where the serious effort is being applied. And it is the custom in the industry when one appliance is being driven to consider that enough.

It is easily understood that one refrigerator outweighs one cleaner or one clothes washer in its appeal to the power company, because of the greater load it brings. But that does not alter the fact that the load from ten thousand more cleaners or washers is desirable to any company. There is also merchandising profit and the vital service

to the customer to be considered. But look at the figures.

There are now twenty million wired homes. Up to now about ten million vacuum cleaners have been sold in America. But cleaners wear out and become obsolete in eight to ten years. In 1930 about one million cleaners should have been replaced. Moreover, last year 471,620 new domestic customers were connected to the lines. This therefore totaled a potential market for cleaners of about one and a half million just to take care of replacements and new customers. But only 978,000 were actually marketed.

In a word, we are something like twenty-nine years behind in cleaner selling. Probably seventy cleaners can be placed in every one hundred homes in the average city. It is estimated that fourteen million cleaners could be sold to central-station customers right now. This would mean $700,000,000 in merchandising business and $30,000,000 in annual energy consumption. With clothes washers the situation is the same. Only the figures are different. With dish-washer and kitchen motors not even a start has been made.

Why shouldn't the market for vacuum cleaners and clothes washers be taken care of at the same time refrigerators are being pushed? If it seems convenient or expedient for the power-company sales department to campaign on only one thing at a time, then dependable manufacturers should be called in to organize the sale of the other appliances and get them into the homes.

Conflict in theories of breakdown

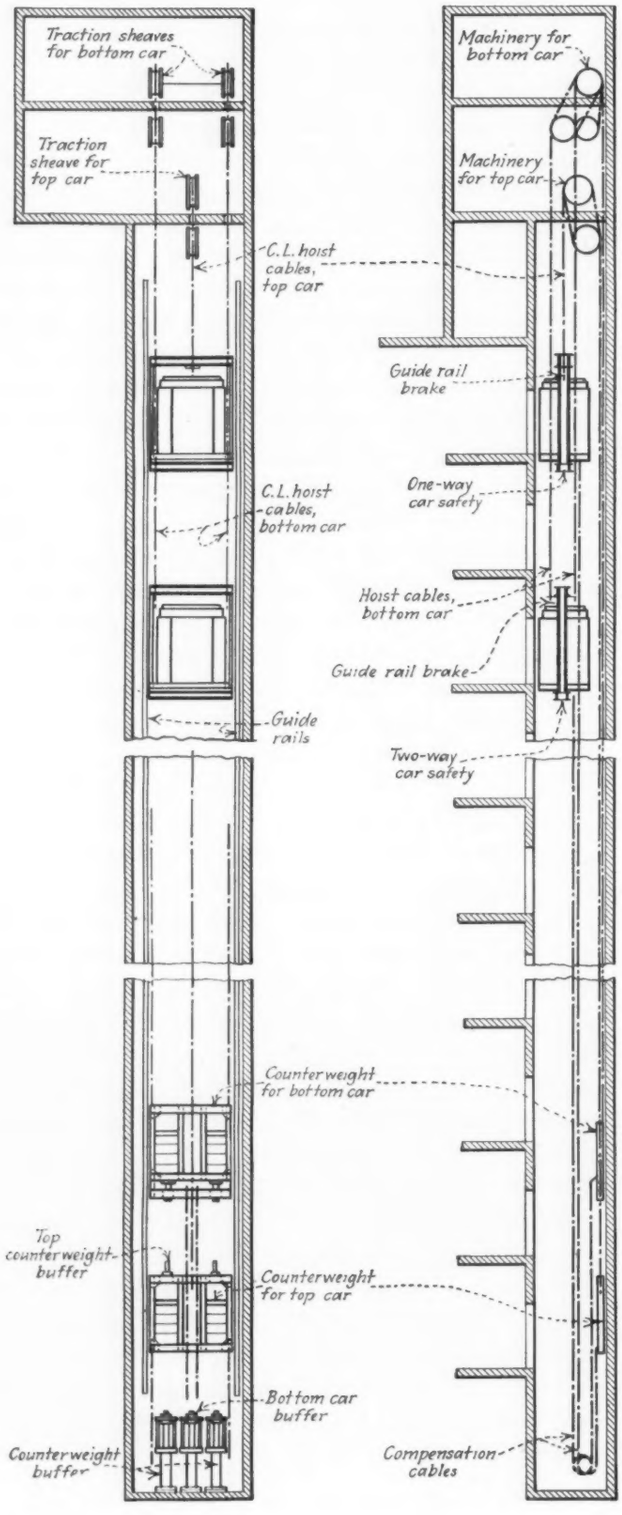
IN THIS age of research it is difficult for a busy man to keep abreast of the advance of knowledge and the new possibilities of its application to the convenience and comfort of mankind. This is especially true of electrical research. Now and then, however, it happens that those who are engaged in research appear to their interested followers to advance a little too rapidly and sometimes to overshoot the mark. This condition is usually revealed by other workers in the same field, in the form of conflicting evidence, and the situation is often followed by interesting and stimulating discussion as to whose results and theories are nearest to the truth. Recent literature on the theory and study of the electrical breakdown of dielectric solids shows that the onward march toward a knowledge of the ultimate nature of electric failure has received a check.

As is well known, the experimental values of breakdown voltage of solid insulating materials fall far below the values which are computed from the best picture, given us by physicists, of the ultimate electrical structure of matter. Not so very long ago Rogowski, following up the studies of Schmidt and Smekal on the irregularities of crystal structure, showed in a very interesting manner that the discrepancy between the observed and theoretical values could be in a large measure removed by considering the especially favorable conditions for ionization by collision which must be inherent in the type of fissure and irregularity shown to exist in most crystals.

Now, however, in a recent issue of *Zeitschrift für Technische Physik,* comes a contribution from Professor Joffé of Leningrad, a distinguished student of dielectric behavior, who contends that the irregularities of structure of crystals have no influence on their electric properties. In a theoretical and experimental study he shows that the temperature change of conductivity of all known crystals is completely accounted for by the lattice ions and that there is no evidence of an influence on the ions supposed to be present in the faults of structure. Other deductions of this type leading to the same conclusion are reported, and in addition the experiments show that artificially produced basic deformations and fissures have no influence on the electrical quantities studied. Of particular interest is the suggestion of Professor Joffé that apparent changes in conductivity and other properties resulting from physical changes are due solely to overlooking the polarization occasioned by the accumulation of space charges.

If one follows these two lines of investigation, it is evident that the apparent conflict of evidence is really a conflict of theories rather than of actual experimental results. It may confidently be expected that discussion will soon clear up any important differences and that the outcome will be an even clearer pathway for subsequent research and, consequently, an earlier arrival at the fundamental truth.

Electric Control Permits Tw



COMBINATION of electrical and mechanical control has made possible the separate operation of two elevators, or even three, in one shaft, thereby permitting a large saving in building space required for elevator shafts. A study of the elevator layouts of certain typical projected buildings shows that the use of dual elevators in these cases would have saved floor space which could be rented for $35,000 to $85,000 a year. At 6 per cent interest these sums justify a capital investment ranging from $500,000 to more than $1,000,000.

For example, in a twenty-story building having four express elevators and four local elevators (going to the eleventh floor) each with 50-sq.ft. shaftway area, 6,000 sq.ft. of floor space would be required for the elevators if the customary single elevator per shaft were used. However, if both local and express elevators are operated in the same hoistway about 4,400 sq.ft. of floor area is required and one-half the number of elevator doors, signals, etc. If the space saved (1,600 sq.ft.) can be rented at $4 per square foot per year the income will be increased $6,400, which is 6 per cent on a $106,666 investment. This makes no allowance for the saving in elevator corridors.

Therefore, it can be said that the entire elevator installation for many buildings over twenty stories high can be financed from the additional income made possible by substituting dual elevators for separate banks of local and express cars. Naturally, the dual operation is chiefly applicable to buildings requiring both local and express service and the economies increase as the number of floors and traffic density increase. In general, dual elevator operation reduces the building volume necessary for hoistways about 50 per cent, three elevators about 60 per cent, and double-decking adds to these savings.

Features of dual elevator hoistway and cab equipment

Observe space for parking cars, ingenious roping arrangement and safety devices. The upper car of the two is the express car. It starts from the street level and runs without stops to eleventh floor, serving floors above that level. It is entirely unrestricted as to its operation except that it is automatically prevented from running downward while the lower car is running upward. It can, however, be "inched" up or down by hand in case of an emergency.

As soon as the express car is out of its way the lower or local car, which has been waiting at a basement level, rises to the street level and then serves the lower ten floors. It, too, is unrestricted except in one respect—it cannot approach the upper car within a predetermined distance. Should an attempt be made to run the lower car up against the upper one, it will be automatically slowed down and stopped at the proper point and held there until either its operator runs it downward or the upper car moves farther upward.

Car operation is so timed that both cars will normally reach their upper limits of travel at about the same time, but if the express car arrives at its destination first, it is held there until the local car completes its run and starts downward.

On the descent of the two cars the same safety precautions apply.

Two Elevators in Same Shaft

The dual elevator installation at East Pittsburgh makes use of essential features of a patent issued to Frank J. Sprague, well-known pioneer in horizontal and vertical transportation. In addition it embodies novel features and equipment developed by Westinghouse engineers, with the executive support of W. S. Rugg, vice-president in charge of engineering. The information on which this article is based was furnished by H. D. James, consulting control engineer, under whose direction the work was carried out.—EDITOR.

Usually buildings that are fifteen stories in height will require local and express zones of elevator service. There seems to be no upper limit to buildings where the use of dual elevators or triple elevators cannot be of advantage.

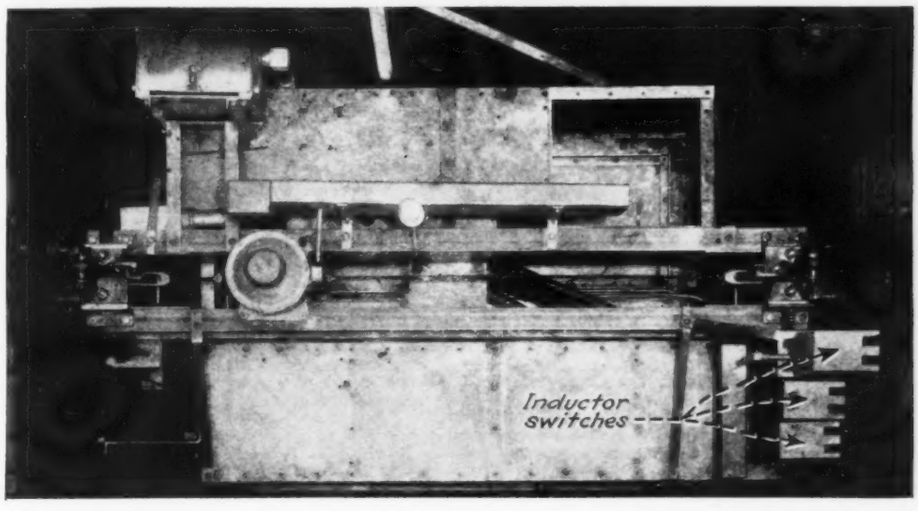
From studies which have been made it appears that dual elevators can be installed for the same cost as normal type elevators giving the equivalent service, making no allowance for the space released for rentable areas.

The dual system of elevator operation involves putting local elevators in the same shaft with express elevators. Where the number of local elevators exceeds the number of express elevators some local shafts must remain. Where the floor area of the local elevator should be larger than the express elevator on account of the increased floor area served, it may be desirable to use a double-deck elevator for local service in order to keep down the size of the hatchway. The scheduled time for a round trip should be the same for both the local and express elevators, when placed in the same shaft. If a double-deck local elevator is used, the number of floors served must be adjusted so as to give the same time for a round trip. The more people carried by an elevator the more time will be required for stops, and therefore the trip must be shortened.

According to data presented by the Thompson-Starrett Company, Inc., in July, 1929, buildings over 20 stories high are not confined to a few metropolitan cities, although New York, Chicago and Philadelphia possess 73 per cent of them. Thirty-six cities have one or more buildings over 20 stories high, there being 377 buildings of such magnitude in the United States.

Following was the approximate geographic distribution of buildings over 20 stories in 1929: New York—194, Illinois—65, Pennsylvania—37, Michigan—19, Texas—13, California—10, Ohio—8, Missouri—5, Maryland and Oklahoma—4 (each), Minnesota and New Jersey—3 (each), Massachusetts and Washington—2 (each), Georgia, Alabama, Florida, Louisiana, Virginia, Tennessee, Rhode Island, Wisconsin—1 (each).

The initial cost of two elevators and the cost of operation will be substantially the same whether these elevators are located in the same shaft or in separate shafts. If located in the same shaft, the cost of building elevator shafts will be reduced and the floor space of the shaftway and corridor saved will add to the revenue of the building. The round-trip time of the bottom elevator will be increased five or six seconds per trip to allow for the landing of the upper elevator, so that this may add a little to the local elevator equipment unless other means can be taken to speed up this service. The percentage of lost time is small and may be negligible in many cases.



Top of lower dual elevator showing inductor switches

The shaftway for a dual elevator will be a little larger than for a single elevator, possibly 10 per cent. This additional shaftway area must be subtracted from the total area saved by eliminating local elevator shaftways and corridors.

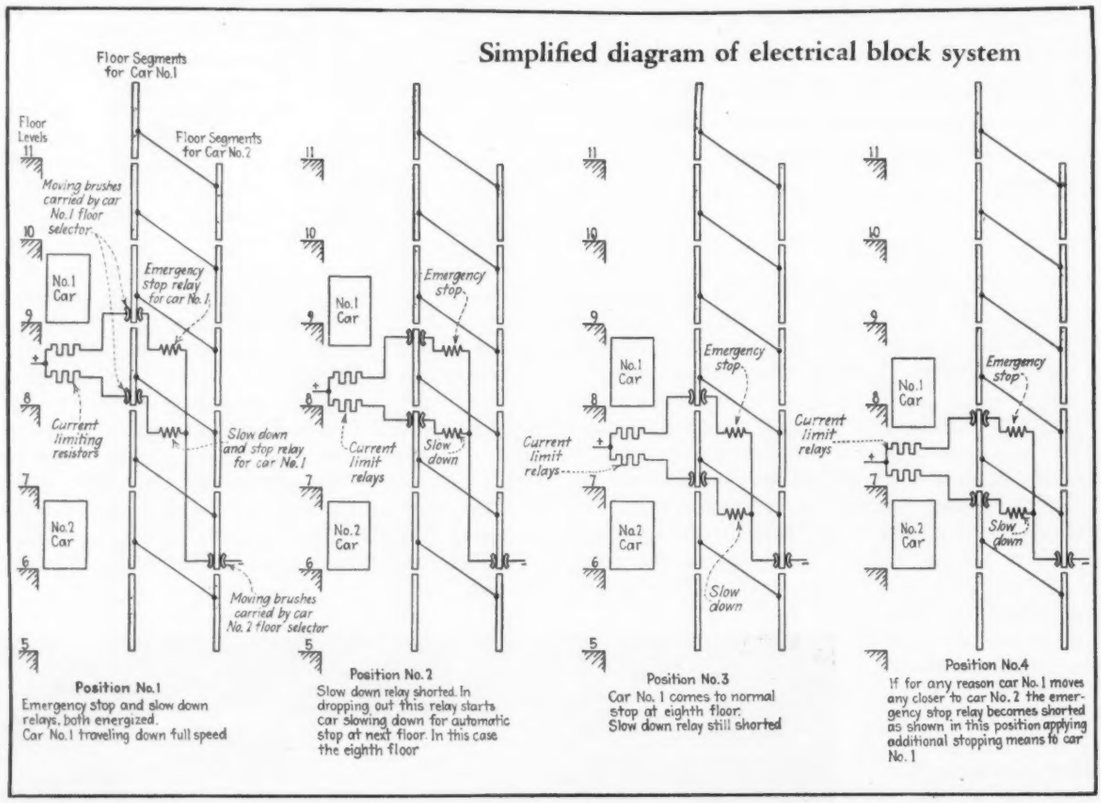
In old buildings where the elevator service is not adequate it can be improved by adding local elevators underneath the express elevators, or adding express elevators above the locals, or both. The service can be further improved by providing two loading levels at the lower terminal. When some of the elevator shafts in a building have an outside exposure it may be practical to put these elevators in one of the other shafts arranged for dual operation and convert the released space into rentable area. The application of dual elevators to old installations will depend almost entirely upon the requirements in each individual case.

Use of the dual elevator scheme does not prevent the addition of other improvements in elevators, such as duplex or double-deck cabs, automatic leveling or landing, automatic acceleration and deceleration, automatic opening and closing of doors, etc.

Incidentally, the Industrial Board of Pennsylvania has removed its restrictions on dual elevators since studying the first installation in the new office building of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Features of this dual elevator installation are shown in accompanying drawings. Attention is called to the ingenious roping arrangement, the space at the top and bottom of the shaft for parking cars when only one is to be operated, and new safety devices, such as those which will be discussed later. Experience with this installation shows that fewer safety devices will be sufficient, but when a departure of this kind is undertaken it is desirable to be on the safe side.

Simultaneously with the development of dual operation, various methods were used to reduce the weight of the elevator, so less power would be required for acceleration and deceleration, so less weight would be impressed on the building structure, and so maintenance would be reduced. Among methods used to reduce weight were the use of aluminum instead of steel for the car frame and safety and micarta panels for the elevator cab. By

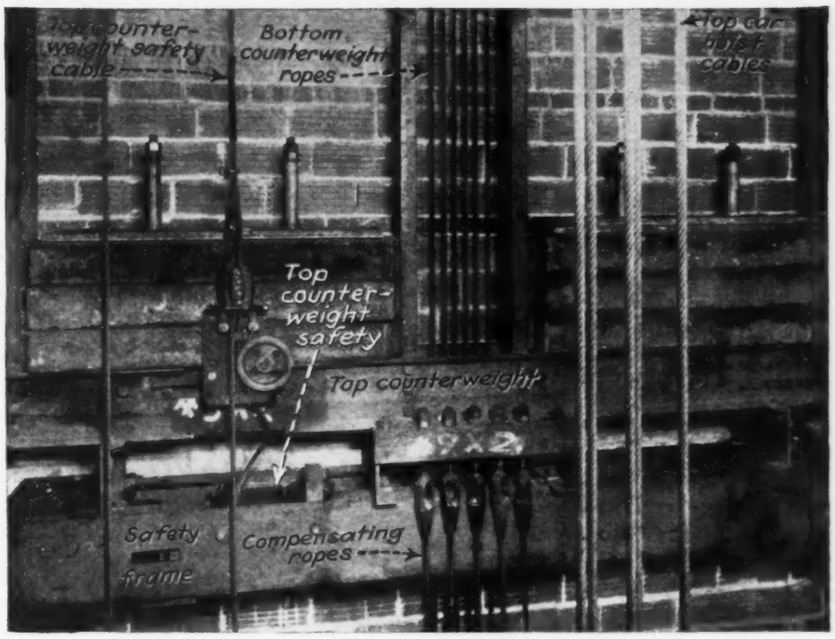

Simplified diagram of electrical block system
Floor Segments for Car No.1
Floor Segments for Car No.2
Floor Levels
Moving brushes carried by car No.1 floor selector
Emergency stop relay for car No.1
No.1 Car
No.2 Car
Current limiting resistors
Slow down and stop relay for car No.1
Moving brushes carried by car No.2 floor selector
Emergency stop
Current limit relays
Slow down
Position No.1
Emergency stop and slow down relays, both energized. Car No.1 traveling down full speed
Position No.2
Slow down relay shorted. In dropping out this relay starts car slowing down for automatic stop at next floor. In this case the eighth floor
Position No.3
Car No.1 comes to normal stop at eighth floor. Slow down relay still shorted
Position No.4
If for any reason car No.1 moves any closer to car No.2 the emergency stop relay becomes shorted as shown in this position applying additional stopping means to car No.1

The assumption is made that car No. 2 has stopped at the sixth floor on the way down and that car No. 1 is descending at full speed. The lower coil controls the relay, which causes the approaching car automatically to slow down and stop two floors above the landing at which the other car has stopped. The upper coil controls a relay which applies an emergency stop to the approaching car. The relay contacts are held normally closed by maintaining the coils in circuit. If any of the sliding contacts in the coil circuit fails the relay will open its contacts and stop the car. When the time arrives for the relay to stop the car its coil is short circuited by two sets of brushes making contact with strips which are permanently connected together. The resistance shown in the circuit limits the current when the relay coil is short circuited.

In position 1 the stop car is approaching the ninth floor. This causes the floor selector brushes to short circuit the lower coil as shown in position 2. This will normally stop car No. 1 at the eighth floor, position 3. If car No. 1 approaches nearer to car No. 2 as shown in position 4, the coil of the emergency relay is short circuited, setting the emergency stop for this car. The exact position of car No. 1 at the time when the slowdown relay is short circuited to initiate the normal stop will depend on the distance between floors and the speed of the car.

Automatic stopping of the lower car in the up motion is accomplished in the same way with a different set of floor selector contacts having cross connections.

At the entrance floor the cars can be drifted closer together by extending the slowdown distance and relying on the governor to stop the car if it does not slow down in a normal manner. Another method would be to provide a spring return button arranged so that the top car could be moved closer to the bottom car by hand control at a slow speed after the normal stop has been made, or after the car speed has been reduced to a low value.

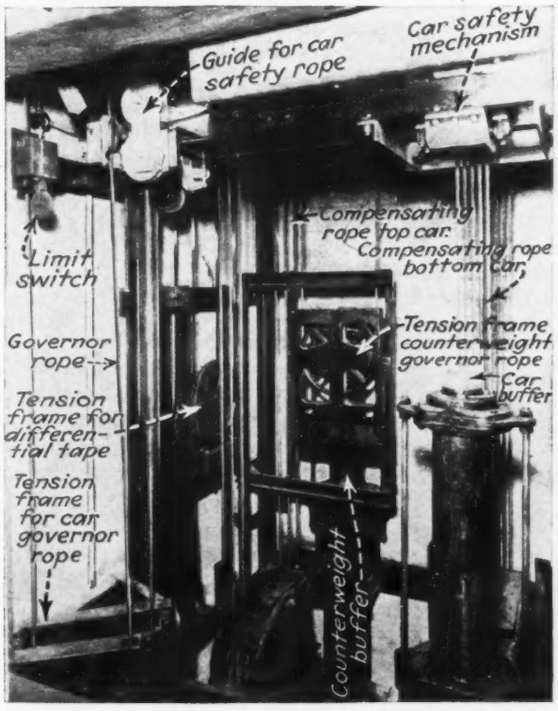


How roping is arranged for dual elevators

these innovations alone it has been possible to reduce the weight of the car 50 per cent, thereby making it possible to reduce the counterweight a like amount, which in turn reduces the load on the ropes and the number and size of ropes.

As an example of the effect of weight saving, a car having 40 sq.ft. platform area weighs 4,000 lb. instead of a probable weight of 8,000 lb. In this particular case a saving of 4,000 lb. in car weight avoids 4,000 lb. in the counterweight, making a total saving of 16,000 lb. on the elevator machine, shaft and bearings, owing to the fact that the ropes pass around the traction machine twice. The total suspended load has been reduced 8,000 lb. As this is a moving load, the corresponding static load for a high-speed elevator would be from 15,000 to 20,000 lb. This reduction of loading on the building is due to one elevator only. If there are twenty elevators, there will be a saving of twenty times this amount, which would mean some definite economy in the building structure.

In the preceding example the maximum live load is 3,000 lb., the car 4,000 lb. and the counterweight 4,000 lb. plus 1,200 lb. for weight of cables, making a total suspended load of 12,200 lb. If steel had been used instead of aluminum and micarta, the suspended load would have been 20,200 lb. The saving in weight therefore is 40 per cent. This means that 40 per cent less energy is required for accelerating the car and 40 per cent less force will be required for stopping it. The latter is an important factor from the safety standpoint. Maintenance will be reduced as there will be less strain on the equipment and less energy required for starting and stopping. Since less power is used, the wear on the controller and brake shoes will be reduced. In some cases the reduced weight may permit smaller elevator equipment to be used.



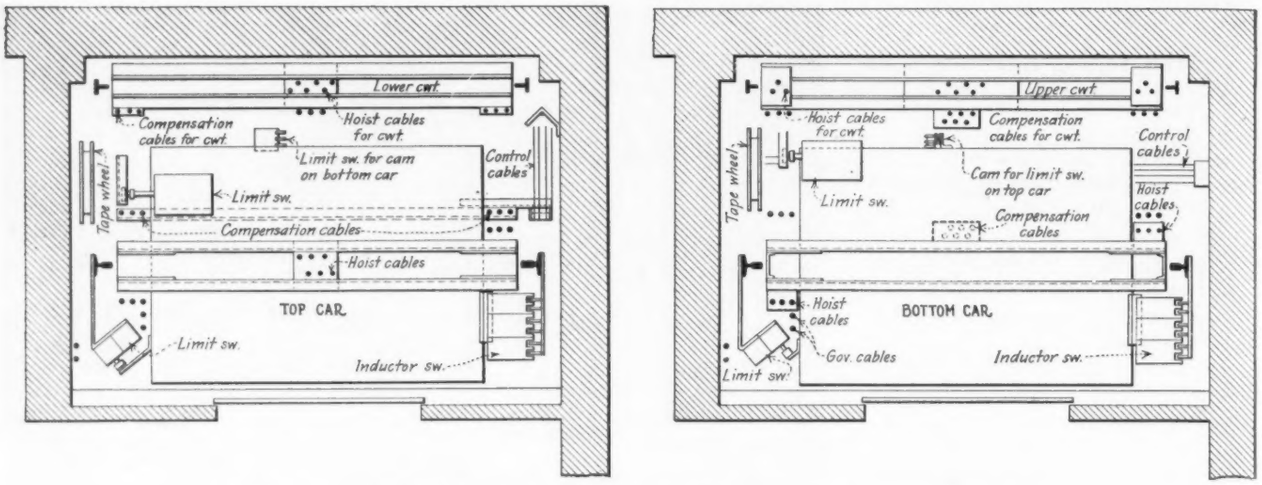
Pit of dual-elevator hatchway and bottom of lower elevator

Safety uppermost in design

Safety was uppermost in the design of this system. Three safety systems are used—one electrical, two mechanical. Each car becomes the limit of travel for the other, just as the top and bottom of ordinary hatchways now are. Similar safety methods are used to prevent over-running these limits. In addition a block system of control is used similar to that employed in railway transportation. When one car approaches the other, it first slows down and then stops, the same control being employed as used for normal operation. The block system is shown in simplified schematic form in an accompanying illustration.

In case the block system should fail a differential safety comes into action. It consists of a differential gear attached to each of the cars by a steel tape so that movement of the gear is dependent on the relative position of the cars. Its action is selective in that it does not interfere with the leading car. The approaching car is reduced in speed and finally stopped in three stages by the differential control:

1. Separate electrical connections are established for reducing the speed of the car. These operate on a circuit which is separate from the normal circuit, so that

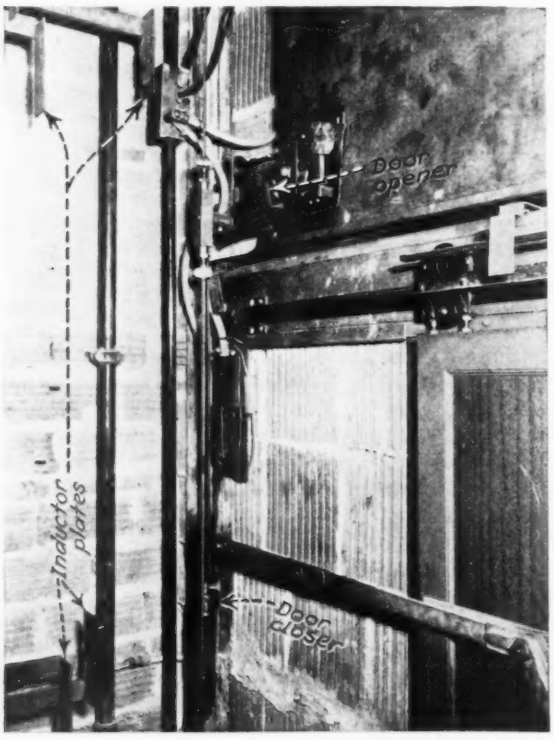


Position of special equipment on tops of upper and lower elevators

the differential safety will operate even if the normal control circuit becomes disarranged.

2. If the car continues to approach a dangerous position, the emergency stop circuit is set, which applies both dynamic and mechanical braking to the elevator machine.

3. The differential gearing is connected to the governor in such a way as to reduce the tripping speed of the governor for the approaching car so that the car safeties will be tripped if the car enters a dangerous zone at an unsafe speed.



Mechanisms operating dual-elevator hatchway doors

Green, amber and red signals in the cab of each car have the same significance as traffic signals and are backed by the automatic control. Automatic operation can be changed to manual operation in an emergency to permit slow movement of either car toward the other. In each cab is also a safety switch, which can be set manually in an emergency. Automatic emergency switches on the top of the lower car and on the bottom of the upper car operate to disconnect power if the cars drift together.

On the upper counterweight is a safety switch which prevents it dropping onto the lower counterweight in case all ropes break, but such an occurrence has been very infrequent.

The car safety is set by a very small movement of the car after the governor trips. This initial pressure of the jaws against the rail is exerted by a spring. Further movement of the cars causes the jaws to grip the rail with increasing force.

Buffers are provided at each limit of travel—top and bottom of shaft and also between cars and between counterweights.

▼

Homes Use Half the Lamps

The consumption of incandescent lamps is almost evenly divided between domestic use and commercial and industrial use. The following table shows the allocation for 1928, 1929 and 1930. The totals are essentially correct, being based on known production; the share assigned to each class of service is necessarily an estimate:

Service or Type	No. of Lamps	List Value
1928		
Residential	150,000,000	$53,000,000
Commercial and industrial	171,900,000	61,600,000
Miniature	254,000,000	49,700,000
1929		
Residential	160,000,000	54,000,000
Commercial and industrial	195,000,000	65,300,000
Miniature	278,430,000	51,093,400
1930		
Residential	180,000,000	56,000,000
Commerical and industrial	173,800,000	61,000,000
Miniature	233,950,000	38,860,000

Pressures, Temperatures, Reheat Increase*

By A. G. CHRISTIE

Professor of Mechanical Engineering
Johns Hopkins University, Baltimore

Steam turbines will be built for high economy over a wide range of load when using higher steam temperatures and pressures than at present. Blade materials will be improved better to withstand vibration and erosion, and this improvement will increase the reliability and availability factors of the turbines. Greater care will be taken to fit the turbine to its load conditions than heretofore. Finally, the use of binary cycles will increase.

The probable limiting performance to be expected of a steam turbine has not yet been approached. Probably the best estimate of this limiting performance is that for a large plant with steam at 2,500 lb. per square inch, 1,000 deg. F., having two stages of reheating to the same temperature, and with six stages of bleeder heating, leading to a station heat rate of about 9,500 B.t.u. per kilowatt-hour of net output. Within the bounds of our present knowledge, this may be taken as the best performance to be expected of a steam turbine.

THE present trends of steam turbine development are toward (a) use of higher steam temperatures and pressures, (b) increased capacities at the various speeds and increased output from a single casing, (c) employment of better materials for turbine parts and particularly for blading, (d) higher efficiency over a wide range of load, (e) adjustment of the turbine more closely to the particular requirements of service, and (f) the development of binary fluids for use in turbines. The effect of such tendencies will be the production of larger, more reliable and more economical turbines than those now available.

Metals such as were formerly used in turbine construction develop undesirable properties at temperatures above 750 deg. F. Tensile strength and fatigue limits decrease rapidly at higher temperatures, while the tendency toward that indefinite elongation known as "creep" also increases. The limiting temperature in a steam turbine is therefore fixed by the properties of available metals. "Creep" cannot be entirely overcome. However, parts may be so designed that the working stresses will lead to a rate of creep at the given high temperature which has been considered within safe limits over a period of years. Certain designers have chosen this rate of creep as 0.01 per cent per year, and this or a similar figure may be accepted as a standard rate for high temperatures.

With this rate of creep and with materials now available, turbines can be built for steam temperatures up to 900 deg. F. with assurance of satisfactory operation, while units for 1,000 deg. F. can be constructed with every hope of successful operation throughout their useful life.

The application of higher steam temperatures will have a profound influence on future station design. Previously turbines with no reheating were limited to initial steam conditions of 450 lb. per square inch and 750 deg. F. If higher pressures were used with the same temperature, the moisture content at exhaust became excessive. Conservative designers aim to keep this moisture content below 12 per cent to prevent erosion in the last blade rows. A single cylinder turbine of 68,000 kw. with no reheating has already been built for 650 lb. per square inch, 825 deg. F. With 900 deg. F. steam temperature the steam pressure may be raised to 750 lb. per square inch. Hence substantial increases in steam pressure may be expected in future non-reheating turbines when temperatures above 750 deg. F. are employed.

A large number of American stations now use, or will soon use, 1,200 to 1,400 lb. per square inch steam pressures, with steam temperatures of 750 deg. F. and with a single stage of reheating. Steam temperatures of 900 deg. F. may make it economical to increase the steam pressure of reheating stations to 2,000 or 2,500 lb. per square inch.

Steam conditions in future stations will probably be standardized as follows: With no reheat 400 lb. per square inch, 750 deg. F., and 700 lb. per square inch,

**Based on a paper presented at Midwest Power Conference, Chicago, February 11.*

850 deg. F., while with one stage of reheat, 1,400 lb. per square inch, 750 deg. F., and 2,000 to 2,500 lb. per square inch, 900 deg. F. In the latter case two stages of reheat may be used if high efficiency is desired.

These considerations apply in general to large central stations. However,

the gains from increased temperatures and pressures are equally applicable to industrial plants. When such plants operate without vacuum or exhaust against back pressure into a service main, the proportional gains from using high pressure and high superheat are larger than in condensing central stations.

Floor space per kilowatt decreases with increasing size. This results in a smaller turbine room and a lower building cost per kilowatt. Steeple compounding has been introduced to provide a further saving in floor space. Manufacturers are endeavoring to reduce the lengths of their turbo-generator sets to save more floor space. The weight per kilowatt decreases with increased ratings. Hence foundation costs are lessened. The efficiency also tends to increase with higher turbine capacities, though at a lesser rate in the largest units. First cost per kilowatt also decreases with increased capacity. The economic justification for the trend toward higher capacities is evident from a consideration of these data.

Single-cylinder condensing units of 10,000 kw. at 3,600 r.p.m. have been built in this country. American engineers favor the single-cylinder units as they decrease station cost and are simpler to operate. Large sizes of single-cylinder turbines are now available at 3,600 r.p.m. Turbines can be built at this speed up to 50,000 kw. in two tandem cylinders and up to 100,000 kw. when two low-pressure cylinders in tandem are provided. These turbine capacities are beyond the limits of any 3,600-r.p.m. generators developed to date. These compound units have certain economic advantages that deserve consideration. Their weight is less than a unit of similar capacity at 1,800 r.p.m. The shafts are shorter between bearings, and, having less mass, can start under high temperature conditions more rapidly than units of the same size at 1,800 r.p.m. Finally, the efficiencies with the same blade speeds and same kilowatt rating are higher in the 3,600-r.p.m. than in the 1,800-r.p.m. units.

These advantages, when more generally recognized, will lead to a wider use of large turbines at 3,600 r.p.m.

Multi-cylinder units at 1,800 r.p.m. have been built in tandem up to 160,000 kw. Such tandem-compound units for large capacities are finding favor among power plant designers and will be used more extensively in the future. Triple-tandem turbines up to 150,000 kw. at 1,800 r.p.m. for 1,200 lb. per square inch are under construction. Cross-compound turbines with several generators ranging up to 208,000 kw. are being used in increasing numbers. The trend in central-station practice is toward the use of larger units and the above capacities will be exceeded when system loads warrant the increased sizes of turbines.

Many turbine difficulties are traceable to blade troubles. Blade vibration is a common cause of failure. Much research work must still be done to find the proper location of lashing wires, the correct method of silver soldering these wires, the best form of shrouds and even the most effective form, size and angles of the blades themselves to resist vibration in the larger sizes of turbines now used.

Blade speeds have been steadily increased until tip speeds of 1,150 ft. per second are now in use and require long blades of high strength and rigidity. Such blades are liable to vibrate. The second trend is the increasing use of large heat drops at high efficiency, which lead to high moisture contents in the exhaust steam. This moisture causes rapid erosion of the blades in the last rows of the turbine, which not only decreases turbine efficiency, but also increases the risk of failure of low-pressure blading and, further, necessitates the replacement of such blades every three to five years. Such replacement is expensive and necessitates a serious outage. Future developments will provide alloy steels for use at these high blade speeds which will have longer life under the wet steam condition in the last rows.

Stainless steels at present seem best suited for long blades. A steel with about 12 per cent chrome and 0.1 per cent carbon has given much promise for such service.

Moisture is difficult to remove from this low-pressure steam. Different schemes, such as drainage grooves, by-pass orifices, etc., have been tried, but the best results so far reported only indicate the removal of about 25 per cent of the total moisture. A study of eroded blades shows that the destructive moisture is concentrated on the outer half of the blade, but not wholly at the periphery. The droplets are undoubtedly of small size and difficult to separate from steam at high velocity. Hence the ineffectiveness of the various catchers and other devices.

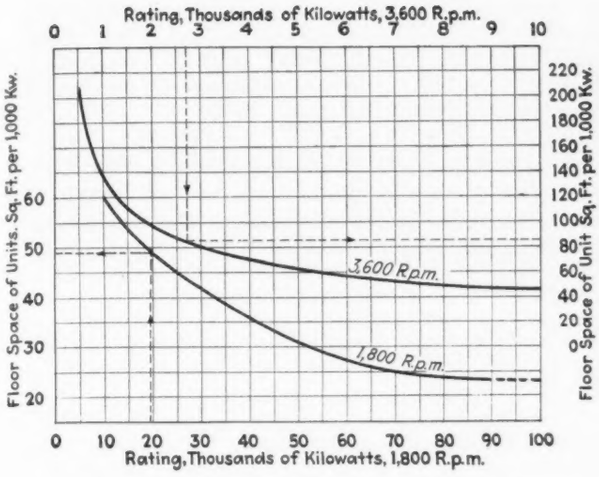
Of the various blade materials tried under these conditions, properly heat-treated stainless steels and some nickel alloys seem best. Plating the edges of these blades with erosion-resisting metals has been tried and heavy plating of chromium appears promising. Sprayed coatings and tantalum sheaths of Hecla and other metals, coatings of stellite, and nitriding also appear to resist erosion and are being further investigated. There is reason to expect that an erosion-resisting blading may soon be developed.

Much trouble has resulted from deposits on turbine blading and a technique has been developed to remove this in stations where the deposits are troublesome. Purer make-up for boiler feedwater, less condenser leakage and drier steam from boiler drums to superheaters will do much to overcome this trouble.

Better efficiencies over wide load range

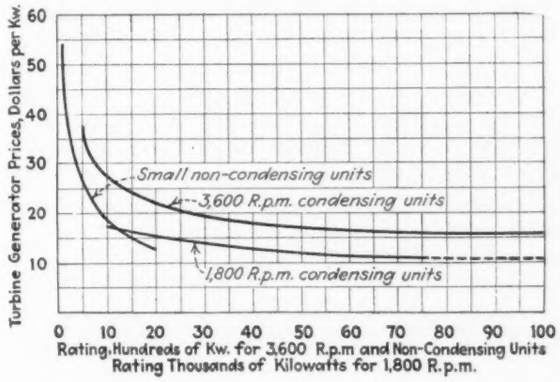
Efficiency in turbines is largely a matter of price. Each manufacturer offers units which will give about the same efficiency and will sell at about the same price as his competitors. Turbines of higher efficiency than these commercial units can be built if one is prepared to pay the higher cost of these improved designs. Load conditions, early supersession by more modern units, changing steam conditions, low fuel costs, and other factors, frequently make it uneconomical to purchase a turbine of the highest efficiency.

Large turbines are generally provided with bleeders and some have reheaters. Hence performance is best expressed in terms of B.t.u. per kilowatt-hour rather than in pounds of steam per kilowatt-hour.


Rating, Thousands of Kilowatts, 3,600 R.p.m.
0 1 2 3 4 5 6 7 8 9 10
Floor Space of Units, Sq. Ft. per 1,000 Kw.
Floor Space of Unit Sq. Ft. per 1,000 Kw.
3,600 R.p.m.
1,800 R.p.m.
0 10 20 30 40 50 60 70 80 90 100
Rating, Thousands of Kilowatts, 1,800 R.p.m.

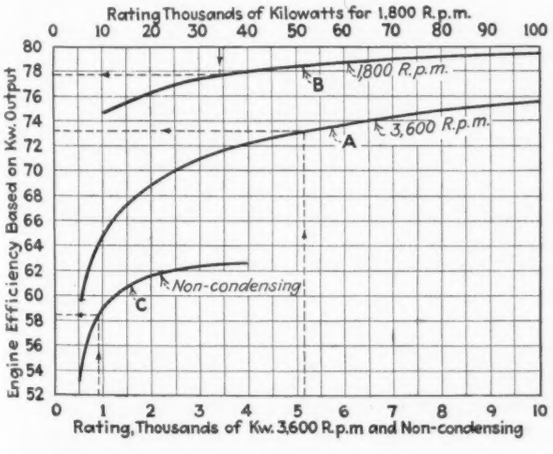
Floor space required for single-cylinder turbo-alternators

This area consists of a rectangle inclosing turbine, generator and direct-connected exciter with an added rectangle for any offset valve gear.


Turbine Generator Prices, Dollars per Kw.
Small non-condensing units
3,600 R.p.m. condensing units
1,800 R.p.m. condensing units
0 10 20 30 40 50 60 70 80 90 100
Rating, Hundreds of Kw. for 3,600 R.p.m and Non-Condensing Units
Rating Thousands of Kilowatts for 1,800 R.p.m.

U. S. prices for turbo-generator units

Prices include bare turbine and generator without auxiliary generators or direct-connected exciters and are for units delivered and erected. Pressures up to 400 lb. per square inch gage, steam temperatures up to 725 deg. F. and, when condensing, up to 29 in. vacuum.


Rating Thousands of Kilowatts for 1,800 R.p.m.
0 10 20 30 40 50 60 70 80 90 100
Engine Efficiency Based on Kw. Output
1,800 R.p.m.
3,600 R.p.m.
Non-condensing
A
B
C
0 1 2 3 4 5 6 7 8 9 10
Rating, Thousands of Kw. 3,600 R.p.m and Non-condensing

Engine efficiency based on generator

A—Single-cylinder turbines, 3,600 r.p.m.; to 300 lb. per square inch gage, 600 deg. F., 28.5 in. vacuum.
B—1,800-r.p.m. turbines; to 450 lb. per square inch gage, 750 deg. F., 29 in. vacuum.
C—Non-condensing units; to 250 lb. per square inch gage, 550 deg. F., atmospheric pressure at exhaust.

Efficiencies of 82 to 85 per cent at the coupling are obtained on some American turbines, while an efficiency of 87.7 per cent at the coupling is claimed for a European turbine of 85,000 kw. As previously stated, the high leaving-losses inherent in the design of many turbines of large capacity lead to moderate efficiencies of such units. Better performances may be expected to result from lower leaving-losses, from reduction of moisture in exhaust stages, from improved blading in the high-pressure section and from a greater combination of impulse and reaction effects in all blading. Regarding the latter, there is already a tendency to secure reaction effects from blading on types of turbines which were formerly considered as of the pure impulse type.

Recent designs provide for high efficiency in B.t.u. per kilowatt-hour over a wide range of load through the use of secondary, tertiary and even quarternary inlet valves. The governor design becomes more complicated when such additional admission valves must be controlled. Manufacturers provide inherent excess capacity in many turbines so that full load can be maintained should boiler pressure drop below normal. But generators are designed with little spare capacity, and if additional overload capacity is desired, this must be specified and paid for, or the generator may be purchased for a lower power factor.

The last high-pressure heater is frequently furnished with highly superheated steam. It is possible to design a counter-current closed heater to take advantage of this superheat and thus raise the feedwater above the saturation temperature, corresponding to the steam pressure in this heater.

Warren Viessman and the writer showed in a recent paper* that, after a turbine has been fully loaded with all bleeders in service, still further gains in turbine capacity can be secured by cutting off bleeder heaters at the time of peak load. The paper discusses other methods of increasing peak load capacity by discontinuing the use of bleeder heaters when there is no objection to colder feedwater and to additional forcing of boilers. These gains in capacity by cutting off bleeder heaters can be secured after all the gains from other means of overloading have already been obtained. Such methods of providing additional capacity at peak loads can be employed in many present and future central stations.

Reheating of steam is necessary with pressures of 1,200 lb. per square inch and above. Flue gas reheating is apparently gaining ground on account of the marked improvement in station economy achieved by its use. Steam reheating is more convenient in certain stations, but is less economical than gas reheating. The use of diphenyloxide for reheating purposes is being investigated and appears to have interesting possibilities.

The use of hydrogen for generator cooling will probably be the next improvement in turbo-generator construction. All experimental units appear to be satisfactory. Fans for circulating the cooling medium—whether air or hydrogen—should be separate from the generator and be designed for variable speed on large units to save auxiliary power at light loads.

The desire to reduce power costs by keeping station investment at a minimum has led to a study of turbine frames and their economic ratings as fixed by their prob-

*"*Peak Capacity at $24 per Kilowatt*," by Warren Viessman and A. G. Christie, "Electrical World," January 17, 1931, pages 136-140.*

able use factor throughout their whole operating life, and by the cost of fuel. It is obvious that with low use factors and cheap coal, leaving-losses can be increased and the output of a given casing can be greater, thereby reducing first cost, than in the case of a base-load station with expensive coal. A casing may have an economical rating from a dollar standpoint, ranging from 30,000 to 50,000 kw., depending upon the value of K, which is the product of use factor expressed as a decimal, and costs in dollars per 1,000 lb. of steam. If the most economical installation is to be secured for a given service, it is evident that there must be close co-operation between the manufacturer and the engineers of the purchaser in order to find which turbine frame and what rating of this frame will develop power at the lowest total cost in any given plant. No frame hereafter will have one fixed rating. The same degree of

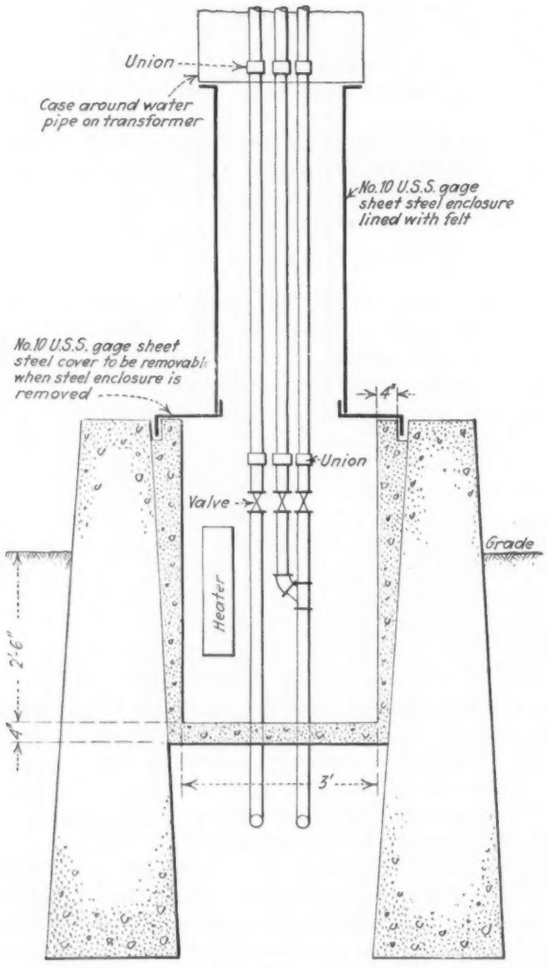
co-operation between turbine builder and purchaser is essential in the choice of an industrial turbine, particularly where this is of the reducing or bleeder type from which steam is to be taken for industrial purposes.

The problems of such turbines are becoming increasingly complicated and require the best engineering skill for their successful solution.

The excellent performance of the mercury boiler and turbo-generator plant at Hartford, Conn., has definitely established that combination as a commercial unit. For ten months last year this plant operated at a heat rate of 10,310 B.t.u. per kilowatt-hour of net station output. Engineers expect ultimately to reduce this consumption to about 8,500 B.t.u. per kilowatt-hour. No data are available regarding initial and operating costs. Consideration must be given to this combination in planning new plant, particularly if this plant is for a base load or for high use factors.

The success of the mercury turbine will encourage attempts to develop processes to use other materials than mercury, such as diphenyl, diphenyloxide, and zinc ammoniate. Some of these, or others yet untried, may prove suitable for power plant use.

No Frozen Water Pipes in Powerton Outdoor Installation



Cooling water supply is guaranteed in any degree of winter weather to the transformers in the yard of the Powerton station of the Super-Power Company of Illinois. The water risers come up through a concrete box in which is an electric heater. Above the box the pipes are inclosed in sheet steel through which the heat rises from below. The inclosure extends up to the case around the water pipes on the transformer and the concrete box extends into the ground below the frost line.

▼

Foot-Candle Factor of Safety Needed in Lighting

By M. LUCKIESH

Director Lighting Research Laboratory, General Electric Company, Cleveland, Ohio

The factor of safety in lighting may be considered as the ratio between the level of illumination required for quick and comfortable seeing and the level of illumination barely sufficient to enable the visual work to be done with the required speed and precision. It is this difference in level of illumination that insures maintenance of speed and precision, ease of seeing and the conservation of human resources. At present few lighting installations are designed to provide an adequate factor of safety. In most cases higher levels of illumination have been installed for the explicit purpose of increasing the output and quality of the work done.

Due to the flexibility of the visual organs in adjusting themselves to a wide variety of conditions, exact information on the relationships between lighting and seeing are best obtained in the laboratory where methods of control are practicable. It is an almost universal laboratory practice to make all measurements at the threshold of visual ability. This is a situation in which the factor of safety is unity. We build bridges with factors of safety many times unity or the point close to failure.

The failure to appreciate the necessity for an adequate factor of safety in lighting is due largely to the fact that the eyes can be forced to operate over a range greater than is possible for most apparatus. The lighting specialist, using the data from laboratory researches and other tests, should make certain that in the final summary of the results a reasonable factor of safety is included.

The public, through long usage of feeble intensities of illumination, has acquired a contentment with low levels of artificial illumination and in some cases an actual resistance against so-called "high-intensity" illumination. Neither of these reactions is prompted by a knowledge of the relationship between lighting and seeing. In presenting the results of researches, it is important to include a reasonable factor of safety or to emphasize the fact that the data are applicable to the visual threshold. While it is manifestly impossible to state here just what the factor may be, it is also obvious that a recognition of the necessity of such a factor will do much toward attaining proper levels of illumination. If a factor of safety is not included, the low intensities of illumination which are sufficient for border-line seeing may lend an apparent scientific support to the prevalent contentment with many existing low levels of illumination.

An appreciation of the wide gap between threshold seeing and comfortable seeing is of particular value to the lighting specialist in recommending higher levels of illumination. This knowledge will enable him to point out that, in such cases where visual work is being accomplished at a low level of illumination, the deficiency of the lighting is compensated by an additional drain on the energy resources of the worker. Inadequate lighting is the persistence of primitive method in a civilization which boasts of electric power in the relief of human muscles.

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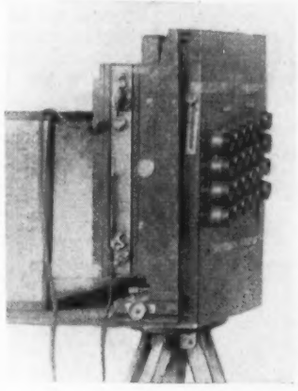
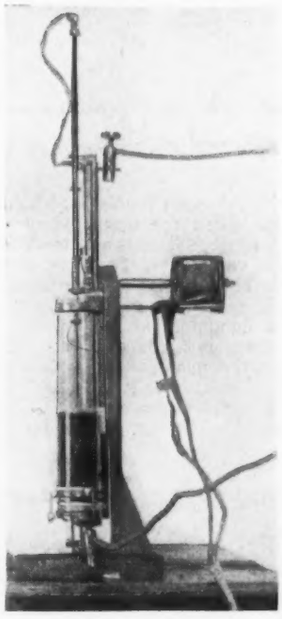
High-Speed Photographs of Arcs in Liquids

By CHESTER LICHTENBERG

Switchgear Department, General Electric Company, Philadelphia, Pa.





High-speed, successive-image camera and miniature liquid circuit interrupter

ARCS sprung in insulating liquids are usually of relatively short time duration. They ordinarily persist from 0.01 to 0.1 second. Besides, they cause a disturbance of the insulating liquid. These factors make studies of arcs in insulating liquids a difficult task.

One method of studying such arcs visually is by a high-speed, successive-image camera. Such a camera is shown. It will clearly record 24 individual successive images at a rate of 550 images per second. It uses a focal plane shutter and 24 lenses suitably arranged in the front board of an 8 x 10-in. camera. The slit in the shutter uncovers a photographic plate and exposes successive portions of it to the images projected through the lenses. Each image registered in the plate represents an exposure of about 0.0018 second. Consequently, arcs lasting, say, ½ cycle of 25-cycle alternating current will register eleven or twelve images.

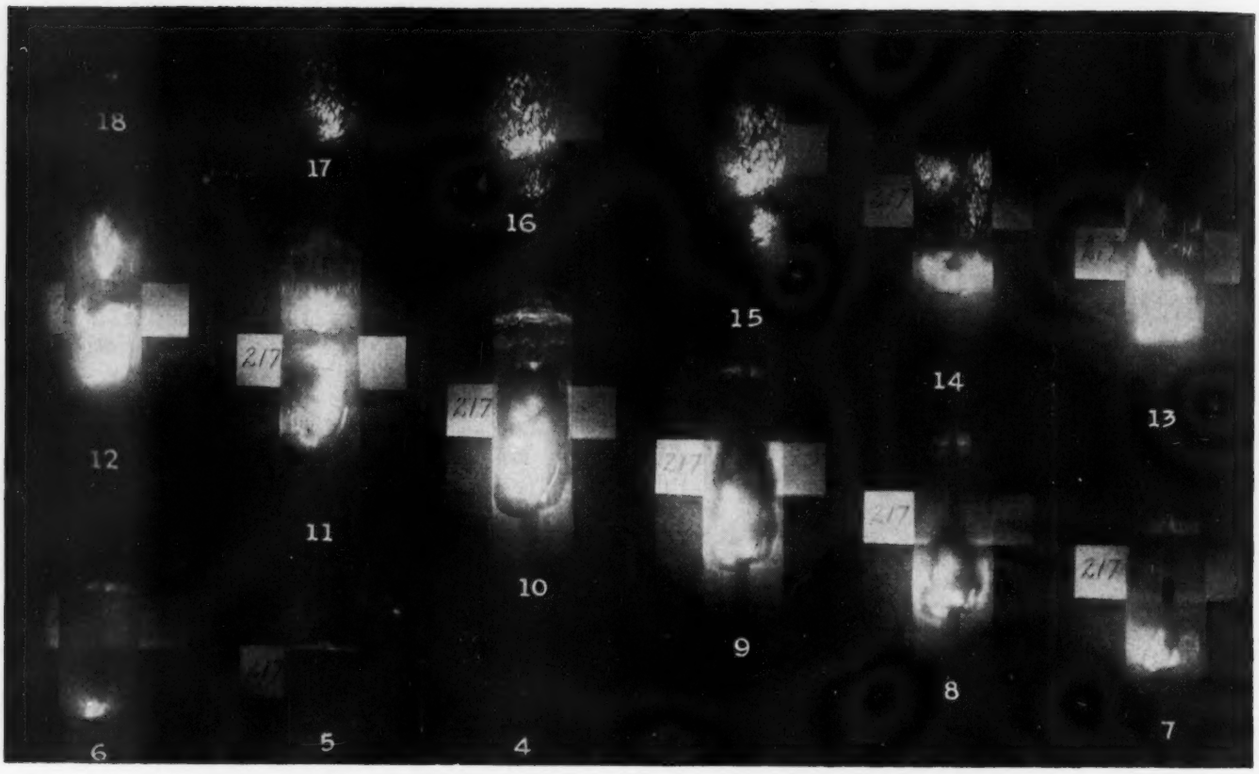
A large number of high-speed, successive photographs have been taken of arcs sprung in various insulating liquids. Some involved cylindrical oil vessels, others rectangular oil vessels and some baffle plates in the path of the parting contacts. The arcs in each case were started by opening a single-phase, 6,000-volt, 25-cycle alternating current carrying 50 amp. at 0.45 power factor. The contacts of the circuit interrupter parted at a velocity of 5 ft. per second.

The same general phenomenon is observed in all of the photographs. The arc is started as the contacts part. Immediately oil or other liquids in the vicinity of the arc is gassified. A gas globule forms around the contacts. It is usually spherical in shape at the start, indicating equal internal pressure in all directions. As the contacts continue to separate, the gas globule expands as a sphere till the containing vessel sides or a

(Continued at bottom of page 323)

Behavior of 6-Kv., 50-Amp. Arc

In all cases a single-phase, 6,000-volt, 25-cycle alternating current of 50 amp. at 0.45 power factor was interrupted. The contacts parted at 5 ft. per second.

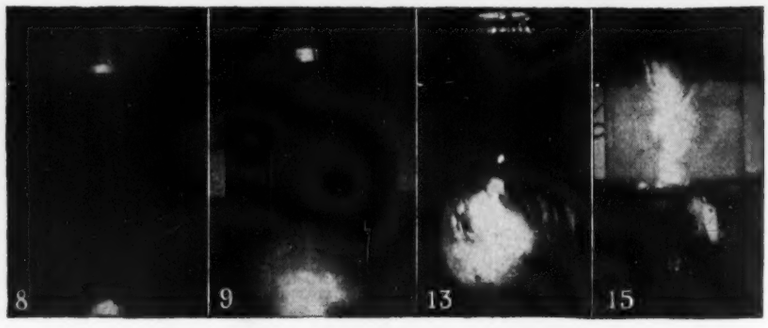


Under a light-colored asphaltic base mineral oil with very low cold test

The single contact moved vertically upward. The oil vessel was cylindrical. There was no baffle to retard the oil movement. The high-speed successive camera was started at the same time the circuit interrupter was tripped. The arc started when the fourth lens aperture was uncovered as indicated by the reflection at the upper oil surface.* The arc is first clearly visible when the sixth lens aperture is uncovered. The oil level is seen to have started rising at this point. It reaches a maximum height with undisturbed upper oil surface when the ninth lens aperture is uncovered. The gas globule surrounding the contacts is first clearly defined when the eighth lens aperture is uncovered. It is seen to increase in size till it reaches a maximum at the time the tenth lens aperture is uncovered. Then the arc punctures the gas globule, the pressure in the gas globule is relieved and the upper oil level starts downward. The oil not only descends when the gas globule is punctured but is also partly thrown violently up in the oil vessel. The descending oil cools and scavenges the arc, as seen when the thirteenth, fourteenth, fifteenth, sixteenth and seventeenth lens apertures are uncovered, and the arc is finally extinguished as the eighteenth lens aperture is uncovered.

**The images are taken from right to left starting in the lower right-hand corner of the figure and ending in the upper left-hand corner.*

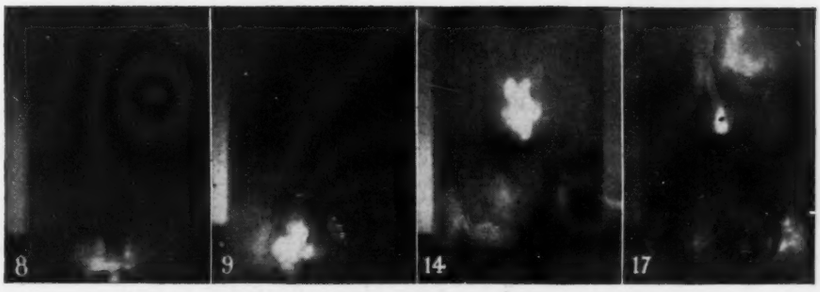
A single upward break cylindrical oil vessel circuit interrupter was again used. It had no baffles to retard the movement of the liquid. The arc started when the seventh lens aperture was uncovered, as indicated by the reflection at the upper liquid surface. The arc is first clearly visible when the eighth lens aperture is uncovered and at the same time the liquid level is seen to have started rising. The gas globule surrounding the arc is well defined as a sphere of increasing diameter as the ninth, tenth, eleventh and twelfth lens apertures are uncovered. The gas globule attains its maximum size as the thirteenth lens aperture is uncovered, and at the same time is punctured followed by the recession of the liquid level. The liquid starts cooling and scavenging the arc as the fifteenth lens aperture is uncovered and extinguishes it as the 21st lens aperture is uncovered.



Under water-white carbon tetrachloride

Under Five Conditions

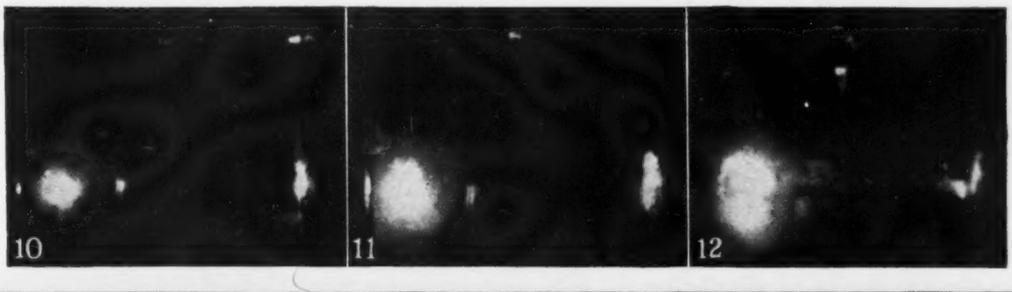
A single, upward-break, cylindrical, oil vessel circuit interrupter was again used. It had no baffle to retard the movement of the oil. The arc started as the eighth lens aperture was uncovered. The spherical shape of the gas globule is well defined and the oil level starts to ascend as the ninth lens aperture is uncovered. The gas globule increases in size till it is punctured, when the fourteenth lens aperture is uncovered. Immediately the gas pressure drops, the oil level is broken and the oil starts to descend. The oil then cools and scavenges the arc when the seventeenth lens is uncovered. It finally extinguishes the arc as the twentieth lens is uncovered.

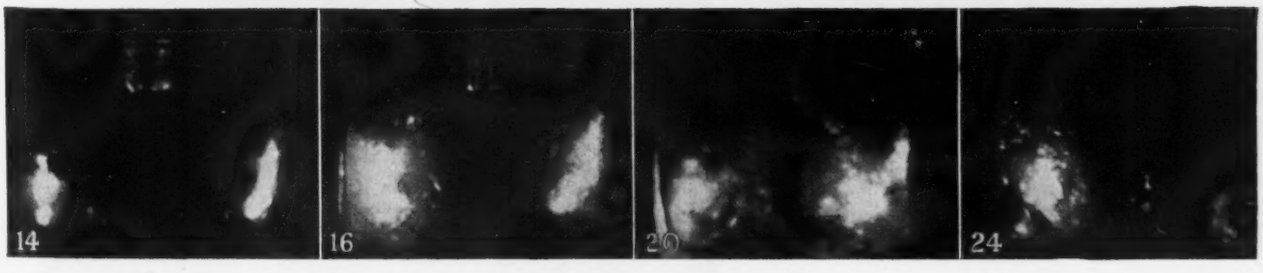


Under usual mineral oil recommended for oil breakers

Vertical, upward-break, using baffle and standard circuit breaker oil

The arc starts as the eighth lens aperture is uncovered. The shape of the gas globule is well defined as the ninth lens aperture is uncovered. The oil level is seen to have risen as the ninth lens aperture is uncovered. The gas globule is seen to expand as the tenth, eleventh and twelfth lens apertures are uncovered. It is prevented from expanding upward, however, by the baffle plate, as shown when the twelfth to 23d lens apertures are uncovered. The arc punctures the gas globule as the fourteenth lens aperture is uncovered. The arc is started to be cooled and scavenged as the sixteenth lens aperture is uncovered. It is extinguished as the 24th lens aperture is uncovered in the camera.





Vertical, double-downward-break

The arc starts as the ninth lens aperture is uncovered. The spherical gas globule is clearly shown at the left contacts as the tenth lens aperture is uncovered. The gas globule continues to expand and elongate as the contacts continue to part. The arc is finally cooled, scavenged and extinguished as the 24th lens aperture is uncovered in the camera.

baffle plate alters its shape. Then it lengthens or broadens. Simultaneously the oil level is raised a distance proportionate to the size of the gas globule. Finally the arc punctures the gas globule. This releases the pressure in the gas globule. Sometimes the release is violent. Then the oil level is disturbed and broken, some of the oil being thrown upward. The remaining oil then descends, cooling the arc and extinguishing it.

Low-Voltage Tube Lighting Available

A new era in the commercial application of luminous tubes was forecasted in the recent announcement by Claude Neon Lights, Inc., New York, of the commercial production of units developed for general interior lighting on 110-volt and 220-volt service (ELECTRICAL WORLD, January 31, page 214). These rare gas tubes are now applicable to commercial, industrial and special residential lighting, and by advances in electrode design and in the mixing of gases a greatly increased range of color effects has been achieved, including the production of artificial daylight illumination on a large scale. Notable gains have also been attained in intensities of illumination, the new filamentless units reaching values as high as 2,000 lumens per foot, against from 60 to 132 lumens per foot for the high-voltage tubes hitherto available.

With the new tubes the light is distributed evenly without the aid of heavy diffusing glass, which has often cut down the efficiency by 40 per cent in the past. It is possible to look directly into exposed tubes for several minutes and turn immediately to read fine print without undue eye strain. The manufacturers state that the rise in temperature of the new tubes is greatly reduced. With these devices the decrease in radiant heat amounts in some cases to 40 per cent in comparison with the same amount of light secured from incandescent lamps. As the colors are derived directly from the gaseous source of illumination and not by filtering white light through colored glass or other devices, the efficiency of tinted light is high. Less than 20 per cent of the power is required to produce blue or green light compared with filtered incandescent lighting; about 33 per cent of the power for red, and about 50 per cent of the power for white. Approximate daylight quality is now available in any sized units.

The increased efficiency attained by these units is expected to lead to the use of much higher intensities in practice, and the absence of glare and the uniformity of distribution realized combine to make this type attractive to industry, commerce and for advanced application by architects in the design of residences, hotels and other structures. In general, the energy consumption is 40 per cent less for a given illumination compared with filament lamps. The life of the units is given as 3,000 hours minimum. On the economic side, the first cost of application may for the present be about double that of filament lighting. It is anticipated that the availability of these units for ordinary interior lighting circuit voltages will bring about revolutionary changes in the design of fittings and that flush type and concealed mountings will become widely utilized. Other possibilities include decorative lighting with dial or other graduated control through electron tubes. A pioneer luminous tube installation utilizing thyratron tube control is in use by the Chicago Civic Opera Company.

Adaptation of the new tubes to low-voltage circuits eliminates the handicap of low power factor associated with previous practice requiring correction in many localities; the Neon company states that the power factor of these tubes exceeds 80 per cent. The high-voltage transformer is of course superfluous under the new dispensation.

To heat the cold cathode 6-volt coils are provided for starting service, with automatic cutting out when operation is established.

Pioneer factory installation

At the Neon company's Long Island City plant a section about 100 ft. square is equipped with nine 220-volt units, each consisting of 96 in. of tubing producing green light and 48 in. of tubing for red light. With 16.5 ft. mounting height, the intensity on the floor is 18 ft.-candles. Each unit is rated at 550 watts. All colors persist through the entire life of the tubes. At present there is a time lag of about seven seconds to start the tubes from the cold state, but it is expected that this will be reduced as the development proceeds.

Other developments include an 80-watt "sun lamp" using a 110-volt neon tube with mixed gases, units for outdoor filling station service (250-watt, 110-volt rating), showcase units in which the reproduction of approximate daylight and reduction of heating are valuable especially in relation to delicate fabrics, and floodlamps and units for picture gallery illumination.

Picture gallery unit utilizing tube lighting

Here 22 ft.-candles of white light are delivered on the wall from combined red, green and blue tube units operated at 220 volts. Plain glass panels without color screening front the unit assembly.

Electrical Industry's Future*

Depends on —Group Co-ordination —Accurate Market Data —Real Salesmanship

By L. W. W. MORROW

Editor "Electrical World"

THE electrical industry as a whole in 1930 did a little better business than it did in 1928, even though this was much less than that done in 1929. General business in 1930 dropped back to 1922 levels. Informed men expect 1931 electrical business to be almost equal to that of 1930, depending upon the rate at which business volume can accelerate after a period of depression.

This business depression has taught some lessons to the electrical industry as well as to all industry. It should serve to make better and more stable business in the future if these lessons are learned and applied. It taught that business should be based upon market facts and that business plans should be made on at least a three-year time period rather than annually. These two ideas should be applied in a practical manner to stabilize future business.

At this time the electrical industry can well afford to take stock and to make plans. It has grown into a business with a $24,000,000,000 investment and an annual revenue of $6,000,000,000 in a period of about 40 years. It has developed into a group of independent branches, each of which is large and complex. It is mature, yet there is every indication that the future will witness the growth of new branches, the expansion of present branches and a still greater degree of complexity.

What of the future?

It is astonishing to note that the industry as a whole and in each division has grown at about the same rate in the past decades and promises to grow at an equally rapid rate in the future. The magnitude of the industry is apparent when it is compared to any other industry and its rate of growth is far greater than the 4.5 per cent per year that represents the growth of general business in this country.

The interesting aspect of the electrical industry is its future. A survey of the future shows even greater business possibilities than those that prevailed in the past. How greatly these opportunities will be capitalized and the rate of business development depend upon a few basic principles:

1. Aggressiveness in selling.
2. Stimulation and encouragement of invention and research.
3. Development of a competent information service on facts, markets, new developments, new-business principles.
4. The practical application of sound business principles in mass production and mass distribution.
5. The maintenance of a good credit standing.

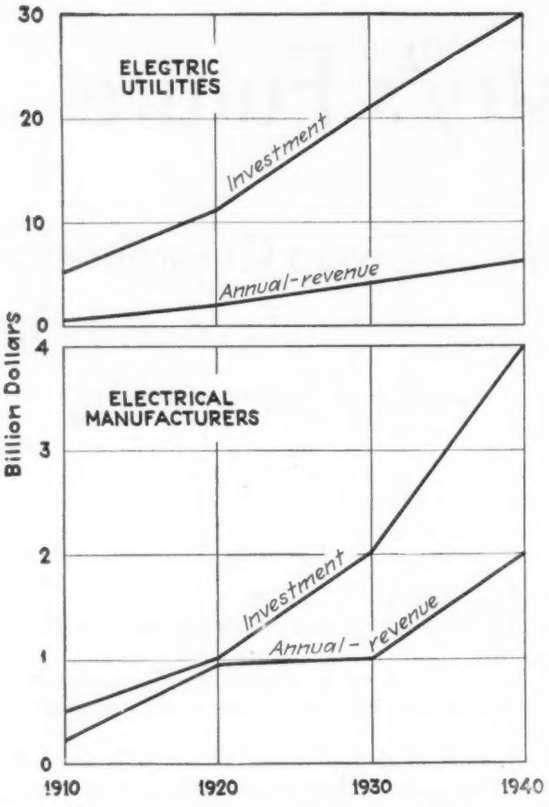
The electrical industry now operates as a group of independent branches and independent business enterprises. There is no unity except in the telephone branch from a business point of view. Neither the National Electric Light Association nor the National Electrical Manufacturers' Association can be said to bring about unity in light and power utilities or electrical manufacturers. Each branch and each enterprise in each branch has grown and developed as a separate business, and only recently has there been an attempt at co-operation or a recognition of the past that what one branch does or one company does may affect the entire industry.

The term electrical industry has no business meaning. It has a meaning only in that it is founded upon the use of electricity and electrical products. Only because of the electrical base, the prevalence of the electrical engineer and the growing commercial interdependence of the branches and units of the business can it be called an industry.

There are about 6,000 executive electrical engineers in the utility branches, 4,000 in electrical manufacturing and 2,000 in associated construction, consulting, research and educational groups. Associated with these key engineers are about 12,000 business executives whose work is intimately connected with engineering and engineering equipment. These 24,000 men represent the electrical industry from the point of view of business conduct, engineering development, purchases and sales. They are the leaders of the 650,000 men and women at work in the industry. They can make or mar industry progress.

This key group has common interests and common problems. Its members must work toward greater unity and economy in the industry and toward greater volume and efficiency in sales. They must keep informed of new developments and of current happenings. They

**Abstract of address, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., January 7, 1931.*



Electrical investment and revenue projected to 1940

cannot stand alone, but must work together despite a definite business affiliation in a particular branch of the industry or in a particular business enterprise.

To make this point of interdependence clearer it may be well to consider typical current policy, engineering, sales and management problems:

1. The Electrified Home.—An analysis of market possibilities shows that the homes of this country offer the largest and most readily obtained electrical market. Yet with present methods of production, distribution and sale, it can be shown that the rate of development of this market is very, very slow and that the methods of development and sale are inadequate and uneconomical. The present scale is 500 kw.-hr. per home, with a reasonable sales expectation of 5,000.

Utilities, manufacturers and other branches are all concerned in the development of this market.

The business problems are tied to distribution, rates, metering, time payments, finance, production, advertising, sales co-operation, apparatus, wiring and many other elements.

The ideal goal is to make it possible in each community for any electrical salesman to sell a completely electrified home to the home owner at one sale, and to have back of this salesman an economical manufacturing, jobbing and dealer distribution system that uses mass distribution principles in purchasing, financing, installation, sales and maintenance.

At present 25,000 different appliances are being sold singly to each home by an unco-ordinated group of independent sales agencies in each community whose selling argument is too often price cutting or long-time payments.

Daring experiments are under way to rectify these conditions. The Courtwright plan in California, the British Columbia plan, the Poughkeepsie plan and the Georgia plan are examples of utility experimentation that the industry is watching. Equally pertinent are the General Electric, Westinghouse and Graybar chains of manufacturers, jobbers, dealers, to carry all products to the ultimate consumer.

No one yet has the practical national business plan that will develop the home market most rapidly and most economically, but many are hard at work trying to find it.

2. Public Policy and Public Relations.—The electrical industry and each branch of the industry operates in a democracy. They operate in the view of the public and under public restrictions. Popular favor and an encouraging legal and political environment are necessary to their success, and these must change as the industry changes.

The telephone utility has admirable public relations today, but upon the light and power branch some politicians are centering their radical attempts to socialize all industry. The manufacturers face some definite restrictions in the Sherman and Clayton acts when they try to work together effectively. Regulation by the government, financing methods and rules, sales ethics and cost accounting all involve public policy. No one branch can act on these matters without the others being affected, and the principles of business conduct found good for one branch will be found good for all.

3. Interindustry Competition.—As sincere advocates of the electrical idea, we believe the electrical way of doing things is the best way and we try to develop all electrical markets to their full possibilities. This is a tangible and co-ordinated industry task, because standards must be made, uniform laws and ordinances must be passed, adequate statistics must be gathered, co-operative sales and advertising methods must be developed, older industries must be shown how to modernize and distribution channels must be made economical. Many elements of policy as well as of sales are involved and the approach to market development must be on an industry-wide basis. The industry is in competition with other industries.

One could go on and enumerate other aspects of business that involve policy. Export trade, living and wage standards, union labor, wiring codes, quality tests for equipment, licensing of engineers, manufacturer-dealer-jobber relations and similar topics are current and more are developing every year.

The electrical engineer and his business associates in all branches must consider and act upon these policy matters.

Possibilities of the next decade

How is the available business of the next decade to be obtained? Nothing can take the place of the initiative and enterprise of individual men and companies that have built business in the past; these are still needed in greater degree than before. But, in addition, there is every reason to believe that co-operative efforts between industry groups can be made effective and useful. The industry as a whole should sell the electrical idea to prospective buyers. The electrical industry is in competition with other industries in the buyer markets: it must work for its own business salvation.

But more is required than a united front in public education and sales promotion. Consistent work should be done to develop constructive legislation in the form of uniform laws and ordinances that encourage full use of electricity safely at a minimum cost. Very hard and intelligent work should be devoted to developing a selling organization that will solve the problem of distribution by getting a large sales volume economically. There is need to develop better trade practices, and much can be done to study markets and to organize to supply the markets according to well-planned programs. In addition, the way should be made evident for the development and acceptance of new equipment and methods so that they may be adopted easily and readily.

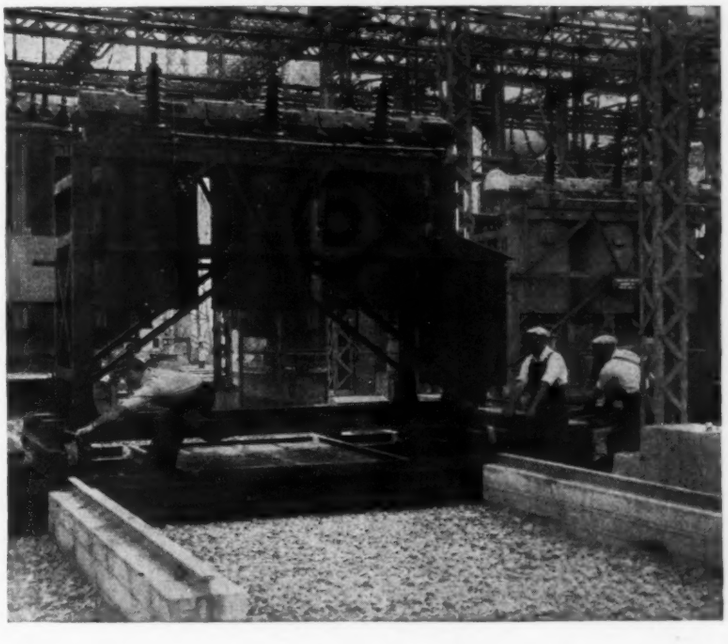
In conclusion, the electrical industry consists of a large group of men with a multitude of diversified activities who must keep informed about trends and facts that arise with respect to electricity, electrical engineering and electrical products and processes. It is necessary that they have market, engineering, financial and other trends and facts presented promptly and concisely and yet oriented so that their business significance is made apparent. No individual can hope to know all that goes on that may affect his business without reading, nor can he measure the influence of any fact or trend on his business unless he has intimate and very broad contacts with all aspects of the industry.

▼

Truck-Mounted Switches Save Bus Outage Time

Three years' experience with truck-mounted oil circuit breakers has proved to the entire satisfaction of the Los Angeles Bureau of Power and Light that the plan used at its station B has materially reduced bus outage time in making inspections and repairs. With one spare breaker on hand only 45 minutes is required to make a complete breaker change. Thus the maximum time any one section of bus is out of service has been reduced from something like half a day to 45 minutes. The accompanying illustration shows the flanged wheel mounting for the breaker, the dolly upon which the breaker is placed and the old electric truck with flanged wheels that furnishes the motive power.

All repairs are made at leisure in the station building, where there is a hydraulic jack for handling the tanks and facilities for handling oil and making necessary repairs. Breakers are inspected once a year unless they have been subjected to heavy duty, in which case inspections are made as often as deemed necessary. The bureau is giving study to inspection and oil filtration and expects to work out a definite schedule of routine inspection for all oil-filled apparatus.

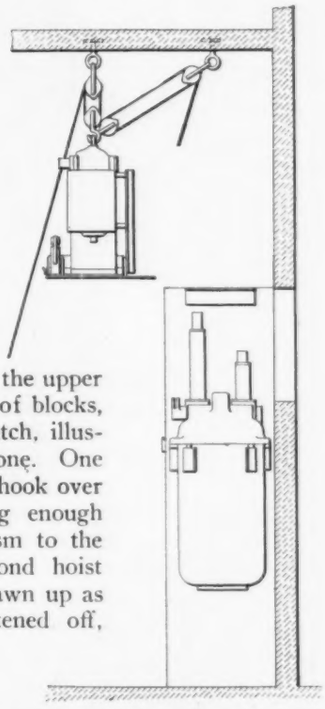


In 45 minutes a complete breaker change may be made

Installation Kink for Cell-Mounted Circuit Breakers

By E. K. READ

Circuit Breaker Engineering Department, Westinghouse Electric & Manufacturing Company



The usual cell structure does not provide much headroom above the operating mechanism of cell-mounted breakers and considerable ingenuity is sometimes necessary to lift the mechanism and put it in place on top of the cell. One operating company solved this problem very easily by placing two hooks in the ceiling, when the upper floor was laid. Two sets of blocks, used as shown in the sketch, illustrate how the work was done. One block was attached to the hook over the aisle and had a long enough hoist to lift the mechanism to the proper height. The second hoist was then attached and drawn up as the first hoist was slackened off, thus transferring the mechanism horizontally to the final position. This scheme is especially valuable if it is desired at any time to remove the mechanism, as no time is lost in hunting for and assembling temporary rigging.

Vertical Distribution in W

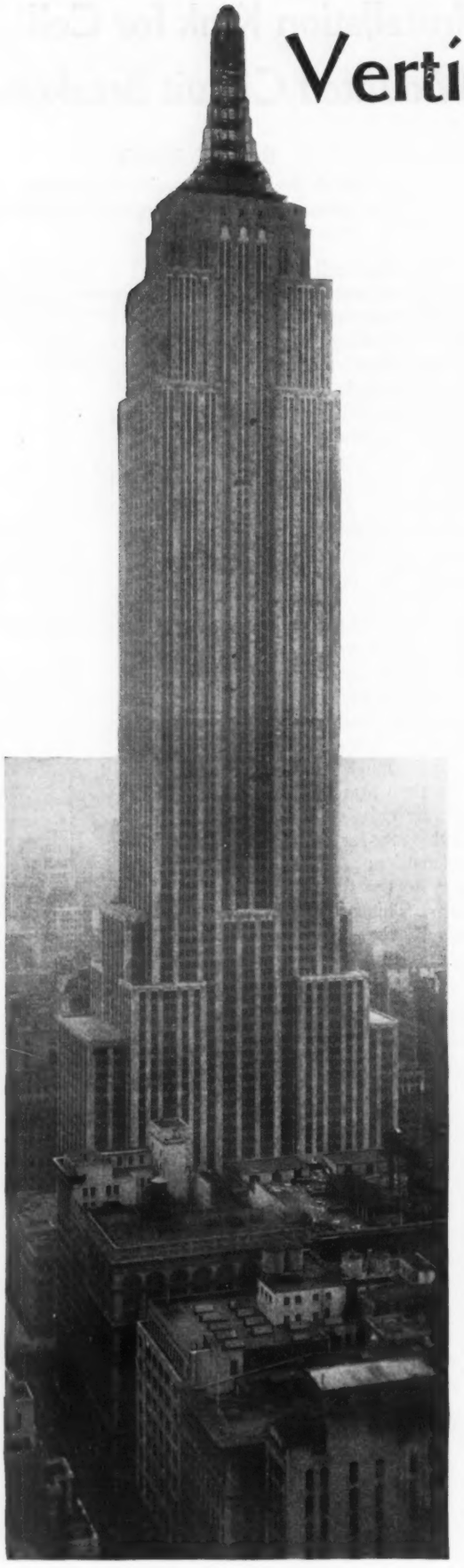
By JAMES A. WALSH

Engineer L. K. Comstock & Company, Inc.
New York, N. Y.

MAN'S tallest edifice, the Empire State Building on Fifth Avenue, New York City, if laid on its side would extend from 34th Street nearly to 39th Street. Electrical service to a building of this size can be visualized as the equivalent of the requirements of the buildings fronting on Fifth Avenue along those five blocks. Quite logically, the 13,800-volt feeders in the street ducts assume a vertical posture in the building, manholes become elevated transformer vaults and the secondary network becomes the radial system permeating the 85 floors of the building. This is the first instance in which a voltage so high electrically has risen so high architecturally. The highest point reached by the 13-kv. cables in the Chrysler Building was the transformer vault on the 70th floor.

Another striking feature of this installation consisted in hanging the 600-ft. length of 13-kv. cables from a single support at the top. Still another feature is the radial secondary extending throughout each of the twenty to thirty floors served from each of the three vaults; the secondary buses are interconnected and tied to the street network of the New York Edison system. The 13-kv. cables are connected solidly to the transformers; protection is provided only through the network switches on the secondary and the circuit breakers at the Edison stations. Virtually any type of tenant's requirements can be met by the flexible distribution scheme, four wire, three phase throughout. Screeding the floor slabs saved 1½ in. in fill and floor height per floor; the underfloor duct system for telephones, etc., thus requiring no raised pad.

The building has a frontage of 200 ft. on Fifth Avenue and 420 ft. on both 33d and 34th streets. The gross floor area in the 85 stories is 2,800,000 sq.ft. and the rental area is slightly under 2,000,000 sq.ft. The 85th floor is 85x135 ft. The estimated connected load is 6,000 kw. for lighting and 9,600 hp. for power services. This estimate for the connected lighting load was based on the assumption of 6 amp. per ultimate lighting circuit. To check this figure computations were also made on the basis of 2 watts and 1½ watts per square foot of area.



The new peak of New York's skyline

Top of mooring mast is 1,250 ft. above the street; height of 86th floor is 1,045 ft.; sub-basement is 34 ft. below street level.

World's Tallest Structure

In all cases the amperes-per-circuit estimate exceeded the wattage-area estimate, thus assuring margin for adoption of higher lighting intensities as the idea meets the acceptance it deserves. As in the case of the Chrysler Building, the Edison power supply is 13,800 volts, three phase, 60 cycles.

Thirteen banks of 200-kva. transformers

To distribute the load in a building of such height and area economically three transformer vaults have been installed, one in the sub-basement, one at the 41st floor and one on the 84th floor levels. In the sub-basement vault are installed five banks of transformers, each bank consisting of three 200-kva. single-phase transformers with 13,800-volt delta-connected primaries and star-connected secondaries for 120/208 volts, three phase, four wire. At the 41st and 84th floors there are four banks of transformers in each vault, each bank consisting of three 200-kva. single-phase transformers, connected as in the sub-basement. The total transformer capacity in the building is 7,800 kva.

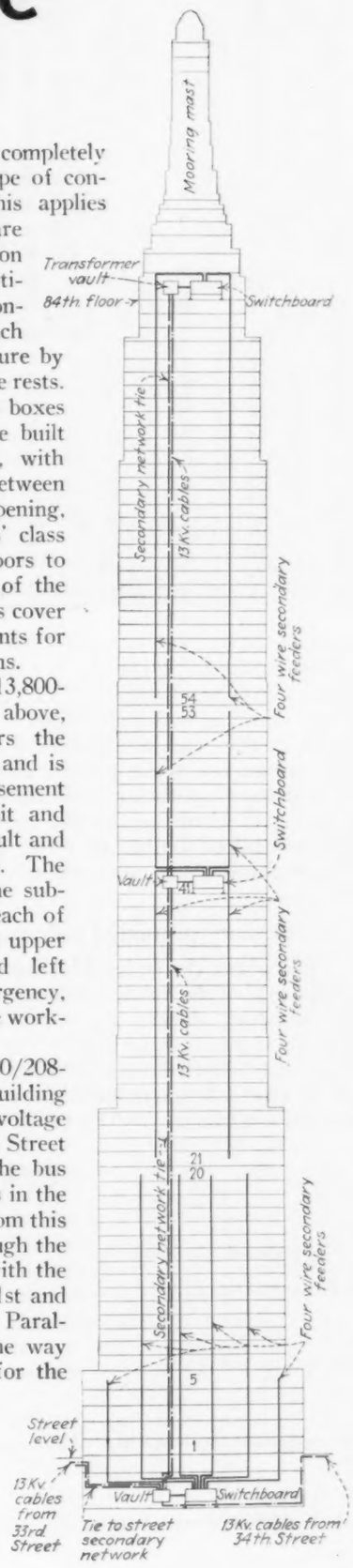
To supply this load, there are five 13,800-volt feeders brought into the building from the Edison underground system in the street. Three enter from service manholes on the 33d Street frontage and two enter from the 34th Street side. At the entrance points the service conduits terminate in concrete pull boxes on the walls. From 34th Street the two feeders leave the bottom of the pull boxes in steel conduits which run under the sub-basement floor to the transformer vault. The 33d Street cables run horizontally in steel conduit on the ceiling of the sub-basement to the transformer vault.

Four 13,800-volt feeders plus a spare cable leave the transformer vault in steel conduits, run horizontally in the fill of the sub-basement floor to a point close to the center of the building, where they turn up into a vertical splice chamber and rise in conduits independent of all other distribution to the 41st floor, where they enter another vertical splice chamber. From the top of the 41st-floor splice chambers conduits carry the cables horizontally along the ceiling of the 41st floor to the vault on this floor. The four feeders continue horizontally on the ceiling to the vertical ducts and rise to the 84th floor ceiling, where they run horizontally once more to the transformer vault on that floor. In all cases where bends in the conduits are necessary to meet structural conditions long radius sweeps were provided to prevent injuring the cable when pulling.

In all cases the conduits used for the raceways are galvanized iron, and are completely covered with an envelope of concrete 2 in. thick. This applies whether the conduits are in the sub-basement fill, on the ceilings or in the vertical riser. The vertical conduits are supported at each floor on the steel structure by means of clamp type pipe rests. All of the concrete pull boxes and splice chambers are built of reinforced concrete, with boiler plate barriers between the cables and full-opening, fireproof, Underwriters' class A doors, with outer doors to match the other doors of the building. These features cover the municipal requirements for 13-kv. interior cable runs.

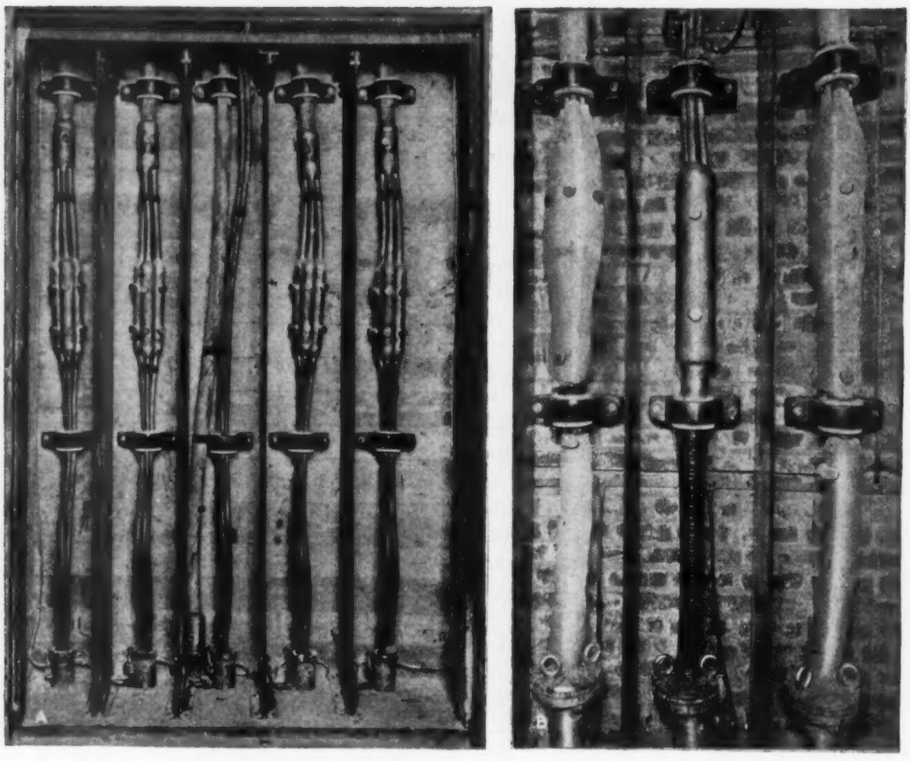
In addition to the 13,800-volt feeder mentioned above, a spare conduit enters the building at 34th Street and is carried to the sub-basement vault. A spare conduit and cable also leaves this vault and rises to the upper vaults. The ends of this cable at the sub-basement vault and at each of the splice chambers and upper vaults are sealed and left ready, in case of emergency, to replace any one of the working cables.

Two low-tension 120/208-volt tie lines enter the building from the Edison low-voltage street network at 33d Street and are connected to the bus on the network switches in the sub-basement vault. From this bus a tie line rises through the building and connects with the network buses at the 41st and 84th floor vaults. Paralleling this feeder all the way is a conduit provided for the



1,000 ft. of up-ended distribution

Vaults in sub-basement and on 41st and 84th floors. Networks extend twenty to thirty floors from each vault. Networks tied together and to street mains.



Splice chambers in sub-basement and on 84th floor

(A) Single-conductor horizontal runs for sub-basement vault are spliced (compound-filled joint) to three-conductor, 13-kv. risers to 41st floor. After completion all cables and joints are arc-proofed. Spare cable and bus tie in central cell.
(B) Cables hang to 41st floor supported by devices detailed in drawing opposite. Central cable with single sleeve is ready for arc-proofing. Others have been arc-proofed over individual sleeves.

network buses at the 41st and 84th floor vaults. Paralleling this feeder all the way is a conduit provided for the totalizing demand metering wiring of the Edison company. In the vaults all pieces of apparatus, conduits, cable sheaths, etc., are grounded to a ground bus. At the sub-basement the ground bus is connected to the Edison street network ground and also to the water main entering the building, on the street side of the meter. The neutral of the bus tie serves as the grounding conductor for the apparatus grounds on the 41st and 84th floors.

Primary protected only at Edison sources

Throughout the entire 13,800-volt network system installed within the building there is no fuse, disconnecting or switching device, the incoming cables connecting directly to the transformers. The only protection other than that offered by the secondary network switches is at the circuit breakers back in the generating stations of the Edison company. The vaults are all located as provided by the city ordinances, so that an outside wall of the building forms one of the vault walls. The other walls of the vault inclosure are of brick fireproof construction and the floors and ceilings of concrete. Natural ventilation is provided through louvers in the outer walls. The vaults are so located that they are more or less isolated from the portions of the building open to the tenants or public. Each vault is subdivided into compartments by brick partitions, each bank of transformers having a separate compartment.

At first thought it may seem strange that no disconnect or circuit breaker is used in any part of the high-voltage network, but considering the fireproof construction of the pull boxes, splice chambers and conduit raceways, the distribution is in reality an underground radial distribution system, with manholes and subsidiary lines to underground vaults modified sufficiently to be adapted to vertical installation within a building.

The cables used on the 13,800-volt network are of two different kinds. In the horizontal conduits from the street manholes to the sub-basement vault and in all of the conduits between the upper splice boxes and the upper vaults three single-conductor, lead-covered cables make up a feeder. The vertical cables between the splice

Comparative Estimates of Load and Demand

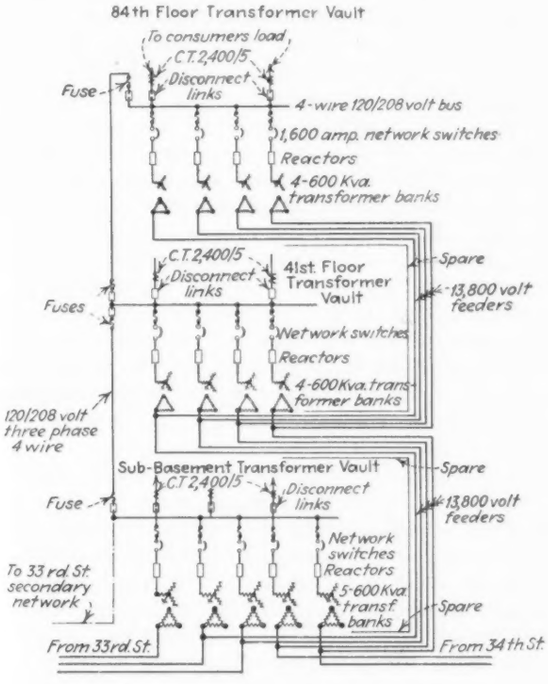
Vaults and Area Served	Connected Load						Demand,	
	Lighting in Kw.			Power in Hp.				
	Basis	Space	Flood	Total	General	Fire Pumps	Total	Kw. plus Hp.
84th floor (822,360 sq.ft.)	2 watts per sq.ft.	1,245	300	1,545	3,217	200	3,417	1,800 200
	1.5 watts per sq.ft.	934	300	1,234	3,217	200	3,417	1,631 200
	1,973-6 amp. circ.	1,420	300	1,720	3,217	200	3,417	1,800 200
41st floor (836,000 sq.ft.)	2 watts per sq.ft.	1,673	...	1,673	2,536	200	2,736	1,664 200
	1.5 watts per sq.ft.	1,255	...	1,255	2,536	200	2,736	1,438 200
	2,430-6 amp. circ.	1,749.5	...	1,749.5	2,536	200	2,736	1,705 200
Sub-basement (1,295,000 sq.ft.)	2 watts per sq.ft.	2,591	...	2,591	3,040	400	3,440	2,311 400
	1.5 watts per sq.ft.	1,943	...	1,943	3,040	400	3,440	1,961 400
	4,094-6 amp. circ.	2,947	...	2,947	3,040	400	3,440	2,503 400
All (2,753,360 sq.ft.)	2 watts per sq.ft.	5,508	300	5,808	8,793	800	9,593	5,774 800
	1.5 watts per sq.ft.	4,131	300	4,431	8,793	800	9,593	5,031 800
	8,497-6 amp. circ.	6,118	300	6,418	8,793	800	9,593	6,109 800

boxes are three-conductor cables with galvanized steel armor wires. The cable is rated for 15,000 volts, is about 3 in. in diameter and weighs about 6 lb. per foot.

Cables hang free from support at top

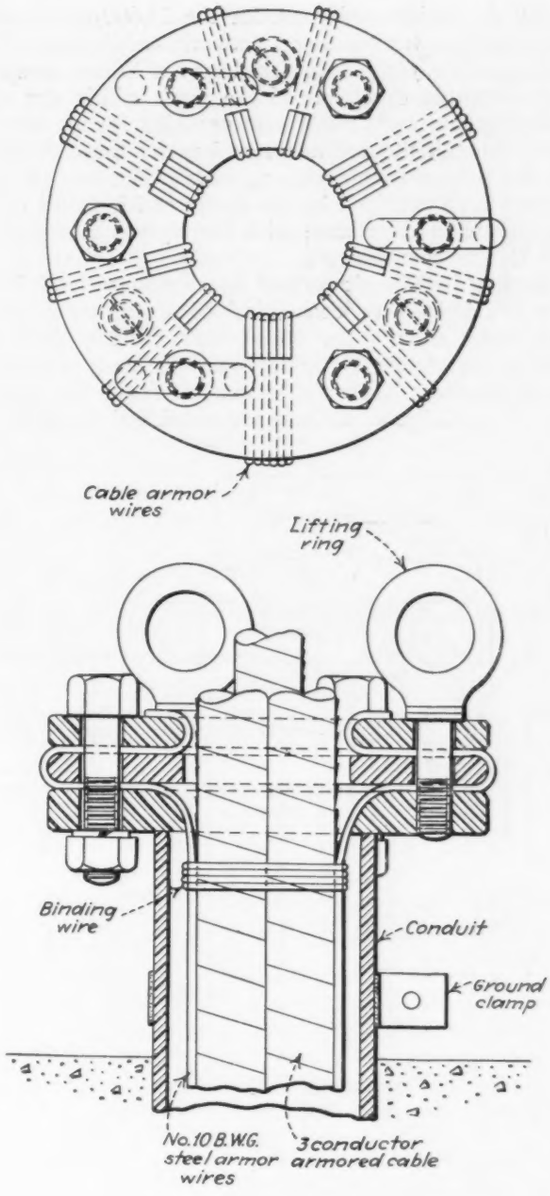
There are no openings in the conduit runs between splice chambers. The only support for the vertical cable is placed at the top, so that the entire weight of the cable is carried by this support, which consists of a special device that clamps the strands of the steel armor and rests upon the conduit bushing. To install this device it is necessary to hold the cable in position after it has dropped nearly its full distance in order to install a temporary split-friction clamp. This split clamp was designed especially for this class of cable installation by our superintendent of construction. When the temporary clamp has been fully tightened the cable is lowered until the clamp rests on the conduit bushing. The tackle is then released and the cable hangs on the split clamp, ready for the installation of the permanent support. The steel strands of the armor are cut, carefully spread and placed symmetrically around the sections of the support and tightly clamped by means of the clamping bolts. When this operation is completed, the tackle is fastened to the lifting bolts provided on this permanent clamp and the cable is raised slightly to remove the split clamp and then lowered until the permanent support rests on the conduit.

All joints on the 13,800-volt system are compound filled. The method of potheading the ends of the three-conductor cable just ahead of the splice to the single-conductor cables is rather novel. In place of a standard



Three vaults house 7,800-kva. transformer capacity

No disconnects on 13-kv. side. On secondary side are balancing transformers, 1,600-amp. network switches and 2,400-amp. current transformers. Disconnects in secondary from bus to load and from bus to street tie.



Support for armored cable

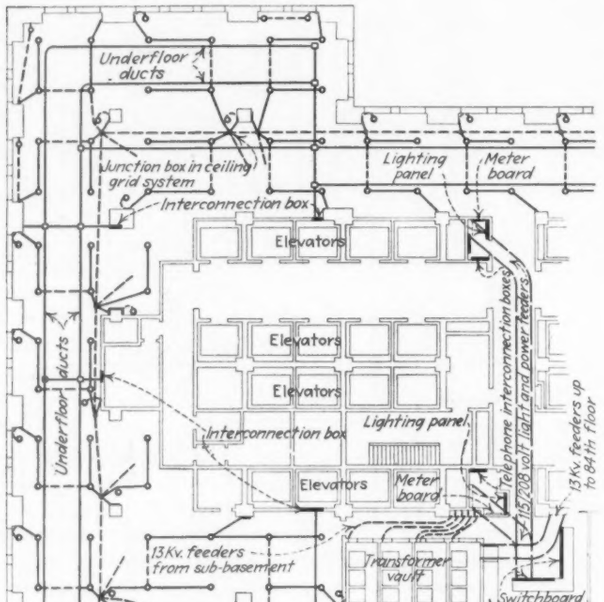
Three-piece clamps grip cable armor wires and support the weight of the 40-floor cable length.

pothead the Edison company uses an adaptation of the compound-filled joint, consisting of a large lead sleeve to slip over the cable armor, to which are attached three smaller sleeves which slip over the individual conductors of the cable. The large end is sweated to the armor and the joints then made between the individual conductors of the cable and the single lead-covered cables.

Expansion and contraction of the vertical cables, which may amount to a few inches at the most, due to the lengths involved and the slight annual change in temperature within the building, was taken care of in two ways. The high riser cable had enough slack in the horizontal run on the 41st floor ceiling within the vault to take care of this factor, while the lower riser cable was taken care of by slack in the sub-basement splice chamber.

All the major equipment for the 13,800-volt installation, such as transformers, network switch units, high-voltage cable, etc., is furnished by the Edison company, but, with the exception of the work within the vault below grade level, the owner provides for its installation, through the contractor and under the supervision of the Edison company's engineers. The conduit raceways are all provided by the owner and installed by the contractor in accordance with the layouts furnished by the Edison company.

Such a 13,800-volt vertical installation within a building is simple, safe, economical of space, conducive to minimized distribution losses and voltage drop and readily adaptable to office buildings and commercial establishments. Admittedly, rentable space that is valuable (especially so because the municipal requirements



Ceiling grid system provides flexibility

Junction boxes are provided with three circuits from nearest panel. Interconnection boxes also promote flexibility. Convenience outlets near outside walls and interior columns.

demand that vaults be located at an exterior wall) must, be sacrificed for vault purposes on the upper floors. This area, in conjunction with the relatively small riser area devoted to the 13,800-volt cables, is, however, far less than would be required for additional secondary shaft area to house the greatly increased size and number of secondary feeders needed to serve the building entirely from transformer vaults in the basement.

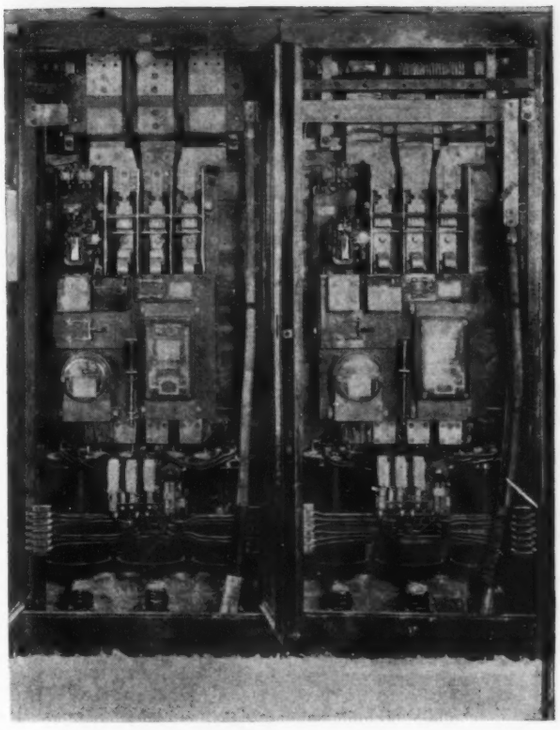
From the star-connected secondaries of the transformers the cables from each bank are brought in conduits installed in the floor fill to a network switch unit consisting of balancing transformers and network switch identical with those used in the underground system. There is one switch unit for each bank of transformers connected through a link fuse to the service bus. At each transformer vault the units are grouped side by side with the service bus, run in a vertical plane just above the network switches. In both the sub-basement vault and the 41st floor vault the network switches are just outside the vaults in the switchboard rooms and are therefore entirely inclosed in steel, but on the 84th floor the network switches are included within the vault.

In all three cases the secondary or low-voltage distributing switchboards are adjacent to the network switches. The connections between the secondary buses in each case are made with busbar installed on hangers from the walls or ceiling, and in these are connected the Edison company's metering current transformers. Three sets of current transformers are used in the sub-basement and two sets in each of the upper vaults. The switchboards are divided into units, with a main fused service switch for each unit. From the switchboards three-phase, four-wire, 120/208-volt color code feeders for light and three-wire, 208-volt feeders for power are installed horizontally in the ceiling to the foot of the various riser shafts. The sub-basement board takes care of all floors up to and including the twentieth, the 41st floor board from the 21st floor to the 53d floor and the 84th floor board from the 54th floor up. The distribution is radial. On the average, three floors are served by each group of 500,000-circ.mil cables that constitute a four-wire feeder.

Flexible distribution to meet tenancy requirements

Because of the area of the lower floors six riser shafts were required to distribute the light and power feeders to the lighting and power panels. From the sixth to the twentieth floor four shafts were required and above the twentieth floor two shafts were necessary all the way to the 85th floor because of the unusually large area of the upper floors. At each floor and in each shaft there was provided a lighting panel of the metering type, arranged with the single-pole knife switch with a N.E.C. fuse in each circuit. The panels are of the polarity type for three-phase, four-wire distribution, equipped with meter bars and meter fuses of such quantity and size as to accommodate tenant areas of any size, including the entire floor if necessary. The grouping of the circuits included in any tenant area was accomplished by means of wire connections between the circuit switches, meter bars and fuses, thus practically eliminating the possibility of tampering sometimes encountered in other forms of metering panels used in sub-metering current to tenants.

The power distributing panels, in general located in the same room with the various items of mechanical equipment served, such as the pumps, fans, etc., are of the knife-switch type with N.E.C. fuses, there being one switch for each motor connected in the building. To take care of the 67 elevators in the building there are free-standing sub-switchboards, similar in all respects to the main switchboards. They are located in the elevator control rooms adjacent to the elevator machines at the various floors where the 67 elevators terminate. The fire pumps, of which there are four, each 200 hp., located, one in the sub-basement and one each on the twentieth, 41st and 60th floors, are connected ahead of the main service switches on the respective switchboards, through special service circuit breakers.



Network protective units inclosed
Two of five metal-inclosed units on 41st floor.

Distribution of current to the lighting outlets from the local lighting panels located in each shaft on each floor introduces a departure from standard practice, in that three-phase, four-wire distribution is used for branch circuits. Ordinarily only two- or three-wire circuits have been used for branches.

The consulting engineers, Meyers, Strong & Jones, used their standard system of lighting distribution for office building work. This system consists of providing, in general, four outlets per bay, with a local switch for each two outlets and a base receptacle on each column, both interior and exterior, connected to what is known as a ceiling junction box, located in one corner of each bay near the column on which are the local switches for that bay. This box is 5½ in. square, slightly larger than the standard outlet box, and serves the purpose of concentrating all the wires for outlets, switches, etc., contained in the bay. The junction boxes in the bays are all connected together with conduit, forming what is known as a grid or header system. From the junction boxes conduits known as the home runs connect to the panel boxes.

The object of the grid and the ceiling junction is to provide flexibility, which is vitally necessary to accommodate the wants of future tenants, the wants and the tenants being entirely unknown at the time the plans are made and the work installed. Under the same conditions, the columns serve as the logical locations of the switches and receptacles. With the grid and junction box system, all conduits between panels and junctions, between junctions, and between junctions and switches are ¾ in. in size. While in many cases this is slightly larger than is required in a fixed layout, it provides the additional conduit capacity often required for certain special tenant layouts.

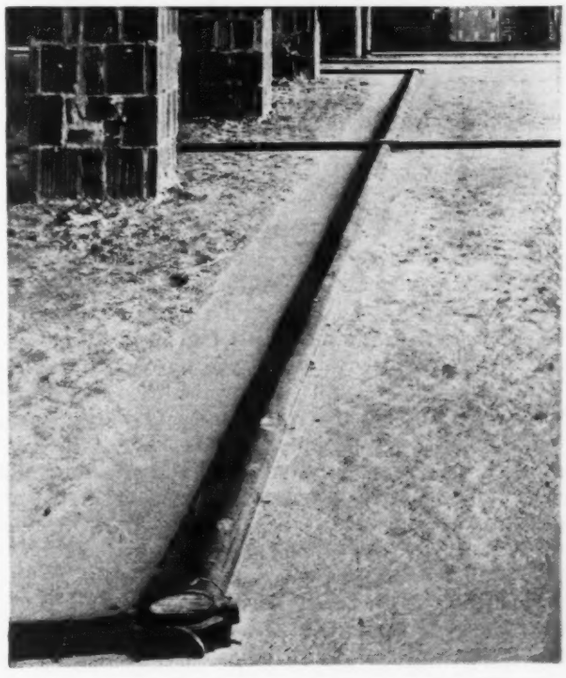
By the addition of wires or the rerouting of wires in the conduit grid system it is possible to accommodate such layouts without installing additional conduits back to the panelboard, which is always an expensive operation after the floors are poured. It is also an easy matter to take care of tenant areas which divide bays by rerouting wires through the grid, a feature necessary where sub-metering of tenants is involved. The flexibility of switching is provided for in having ample conduit capacity to the switch outlet. The partition layouts of tenants vary so much that a system such as described above is necessary to eliminate as far as possible radical alterations of the original work installed. Generally where such a system has been used the alterations are all confined to the work within a bay, leaving the original home runs and grid conduits intact.

The use of the three-phase, four-wire system for local distribution of branch circuits proved an economy in both wire and conduit required and also improved the voltage regulation between the panels and the outlets.

Underfloor duct system

In recent years most high-class office buildings have adopted some system of underfloor distribution to care for telephones and signal devices on desks, which in most cases are located away from walls or columns. The common method of installing wires for such desk devices is often of a makeshift nature, and in this installation an effort was made to minimize the necessity for resort to molding across the floor from partition to desk.

In the Empire State Building the raceway or duct



Screeding floor slabs saves pad
Smoothing of floor-fill as laid avoids necessity of 1½-in. pad, saving that much ceiling height on each of the 85 floors.

consists of a semi-circular section of fiber conduit with an open bottom and a cross-sectional area of 6 sq.in. for the accommodation of wires. In general, there were two lines of duct provided around the periphery of the building, one line about 4 ft. from the outer wall and the other line 9 ft. beyond the first. With this layout it will be possible to bring the wires for a telephone or signal device to a desk located in the space most often requiring such service, namely, in the outer bay near the windows. In a building such as this, where the future tenants' requirements are unknown and where such large areas are involved, a medium course was pursued in providing for the known requirements of the average commercial offices, which utilize the spaces away from the outer bay for files, reception rooms, etc., requiring little if any signal wiring. If such cases do arise the wiring will have to be installed along the baseboard, which is so designed as to conceal the wires.

Ten feet of building height saved

In former installations using fiber duct run in the floor-fill it was found necessary to install them on a raised cement pad, in order to provide a straight level path for the ducts and also permit them to clear conduits also run in the floor-fill. The steel beam construction in this building departs from general practice in that the floor beams are depressed below the structural slab, the girder beams being 1 in. below the structural slab, and the other beams, framed into the girder beams, being 2 in. below the structural slab. This construction permitted the installation of all the electrical conduits in the slab at one time and in such a way as to cover them completely with concrete in the areas crossed by the fiber duct. Under such conditions no raised pad was necessary, resulting in the saving of the cost of the pad as well as the saving accomplished by the decrease of 250,000 cu.ft. in the floor-fill required. The 1½-in. saving in floor depth also saved 10½ ft. in total building height. It also reduced to a minimum the conduit surface exposed to the cinder-fill, where corrosion is likely to attack the metal. Conduit cast in concrete is subject to no such danger.

To provide a reasonably smooth raceway for the underfloor duct it was only necessary to screed the rough concrete slab, shortly after the slab was poured and before it set, along the duct routes and finish it off with a trowel. With the fiber system it is not necessary to have the duct absolutely level as the inserts are not installed until after the finished floor has been completed. Inserts of varying lengths are available to take care of any irregularities, so that the insert when installed can be made flush with the finished floor.

Another departure in connection with the underfloor system was the method used in fastening the duct to the slab. On other jobs various methods of fastening have been used to hold the duct in position on the pad until hot pitch could be poured along the edges to fasten it permanently to the pad. Elimination of the pad and substitution of the screed-finished concrete offered a firmer surface to work with. Fastening wires and nails in the cement pad had proved unsatisfactory. After a little experimenting, however, with concrete nails and wire, it was found that a specially formed steel wire when fastened with a concrete nail on each side of the duct held the duct firmly in place. These wire clips were installed about every 3 ft. This eliminated the inconvenience of handling a pitch stove and moving it about from floor to floor.

The architects were Shreve, Lamb & Harmon, the engineering consultants Meyer, Strong & Jones, Inc., the general contractors Starrett Brothers & Eken, and the electrical contractors L. K. Comstock & Company, Inc.

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READERS' FORUM

Questions Validity of Alleged Lightning Photograph

To the Editor of the ELECTRICAL WORLD:

"Does Lightning Look Like This from Above" is a question which you published under an alleged photograph of lightning, on page 83 of the January 10 issue of the ELECTRICAL WORLD.

So far I have arrived at no adequate explanation of this picture. Of course it is quite obvious to me that the picture cannot be one of a lightning stroke from above because I have enough respect for lightning to believe that if the aviator had been directly in the path of the lightning stroke, or even within a small distance of it, he would not have lived to tell the tale, and I doubt very much whether the plate in his camera would have been preserved.

I have been trying to estimate how high the pilot was above the ground when this picture was obtained. I would judge from the picture of the house on the left-hand side of the photograph that he was not very high above ground, in which case it might be possible that the tail end of the stroke came into the field of his camera. Of course even a lightning stroke lasting a long time, say for 1,000 microseconds, would have started and been over before the plane could have moved one inch. It does not seem likely that it would have been closer than 88 ft. to the channel of the lighting stroke when the stroke ceased, for it takes an appreciable time for the ionization of the channel to disappear, and there is no sign of halation on the plate, which indicates to me that the record, if it is a record of a phenomenon due to lightning, was of something that took place after the stroke was over.

In testing insulators I have seen just such records on photographs when breakdown occurs and a small incandescent fragment is thrown out; this may be a possible explanation of the picture; however, I feel it is rather far fetched, and if we knew more about the location of the aviator and conditions of the ground beneath him we might be able to offer a better explanation.

I don't feel that the picture is of any fundamental importance, but it is quite interesting. I would not recommend that any investigating bodies undertake to make airplane pictures of lightning of this type as I feel that the mortality rate would be rather high.

CHARLES FORTESCUE,
Consulting Transmission Engineer.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Men of the Industry

J. R. McCoy Receives New Appointment

JOSEPH R. MCCOY, commercial manager of the Central Power & Light Company, San Antonio, Tex., has been named vice-president of that company following an association that covers a period of five years. Though Ohio is Mr. McCoy's native state and the abode of his alma mater, Ohio State University, Texas is the setting in which has been staged the larger part of his career as an electrical engineer. He has installed

electrical systems in every sort of institution from theaters to state penitentiaries. It was while he was employed by the Columbus Railway, Power & Light Company that he installed the electrical system at Ohio State Penitentiary. After leaving the Columbus company, where he held the position of industrial electrification engineer, he became identified with the Texas Power & Light Company as commercial manager.

Mr. McCoy left the Texas company in 1926 to become director of the commercial department of the Central Power & Light Company and he has discharged the duties of that office ever since. He will continue directing this department's activities in addition to performing his new executive duties.

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BYRON E. WHITE of the Utica Gas & Electric Company has been named division engineer of the central division of the Niagara Hudson Power System. Mr. White's appointment follows over 25 years' experience in the engineering department of the Utica Gas & Electric Company. During the last several years he has been general engineer of the company. For the present Mr. White will retain his offices at the Utica company, a unit of the Niagara Hudson system. Before joining the Utica company, in 1905, he was with the state engineering department and the United States Geological Survey and served as assistant city engineer for the city of Rome, N. Y.

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J. E. HARSH of Joplin, Mo., vice-president of the Empire District Electric Company, has been made president of the Ozark Power Company, which was recently taken over by the Empire company.

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W. R. PENDER, power plant betterment engineer, has returned from foreign assignments in Central and South America and is now located in Houston, Tex.

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OTTO SNYDER, president of New York Power & Light Corporation and in charge of eastern division activities of the Niagara Hudson Power Corporation System, was elected a vice-president of Niagara Hudson at a meeting of the board of directors on February 5. At the same time NORMAN R. GIBSON, vice-president and chief engineer Buffalo, Niagara & Eastern Power Corporation, was also elected a vice-president.

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EDWARD DAVIS, formerly president of the Philadelphia Storage Battery Company, has been named chairman of the board of the company and JAMES M. SKINNER, formerly vice-president and general manager, has become president. GEORGE E. DEMING has been named executive vice-president and WALTER E. HOLLAND vice-president in charge of engineering.

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FRANK B. STEELE, until recently vice-president and general manager of the Utica (N. Y.) Gas & Electric Company, has opened offices in that city for the general practice of engineering. Mr. Steele will specialize in heating, power, electrical and pumping problems, tests and reports on private industrial power plants, design of steam, hydro, heating and pumping plants and transmission, substations and distribution systems. Mr. Steele resigned as an officer of the Utica utility two years ago after spending eleven years in its service. He is a member of the A.I.E.E., N.E.L.A. and the American Gas Association.

E. C. Stone Assumes New Executive Duties

E. C. STONE has been appointed assistant to the senior vice-president of the Philadelphia Company and subsidiary companies. Mr. Stone, who organized the system operating department of the local light company in 1913, acting as system operator until 1919, is a native of Charlestown, N. H. Following graduation from Harvard University in 1904 Mr. Stone immediately became affiliated with the Westinghouse

Electric & Manufacturing Company at East Pittsburgh as an engineering apprentice, later entering the engineering department of that company, engaged in the design of transformers. In 1911 he joined the Allegheny County Light Company, which two years later become the Duquesne Light Company.

Mr. Stone acted as system operator until 1919, at which time he was promoted to technical assistant to the general manager. He became planning engineer in 1922, in which position he organized and developed the planning division, a new activity in the engineering department, the function of which was to plan systematically and economically the development of the power system to meet the constantly increasing demands which were made on it by virtue of the growth of the company's business. He was made system development manager on January 1, 1927. At present Mr. Stone is vice-president of the American Institute of Electrical Engineers and has just relinquished his

duties as chairman of the Engineering National Section of the National Electric Light Association. He is a member of the advisory board of the International Electrotechnical Commission and a member of the Association of Iron and Steel Electrical Engineers and the Engineers Society of Western Pennsylvania.

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B. B. Morton of Basin, Wyo., has been appointed a member of the Board of Equalization and Public Service Commission of the State of Wyoming to fill the vacancy caused by the resignation of C. L. Draper, who has been appointed a member of the Federal Power Commission.

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James Lightbody, publicity manager of the British Columbia Electric Railway Company, was elected chairman of the advertising bureau of the Vancouver Board of Trade at the annual meeting of that body. Mr. Lightbody has long been associated with the activities of the bureau.

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Herbert A. May has been appointed assistant to the president of the Westinghouse Electric & Manufacturing Company with headquarters in Pittsburgh. Mr. May is identified with a number of important local manufacturing organizations and banks.

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Reid H. Gardner, formerly assistant general manager of the Dixie Power Company, Cedar City, Utah, has been appointed vice-president and general manager of that company to succeed A. L. Woodhouse, who recently resigned. P. R. Larson was appointed to succeed Mr. Gardner as assistant manager.

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Robert S. Hale, long associated with the Edison Electric Illuminating Company of Boston, has resigned. Mr. Hale was a graduate of Harvard and obtained his M.E. degree at Cornell. From 1893 to 1895 he was assigned to special engineering work with the Boston Edison Company and from 1910 has been in charge of the special research department, where, as an authority on utility economic problems, he became widely known throughout the electrical industry.

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Severe Godin, Jr., has been appointed a member of the board of directors of Montreal Light, Heat & Power Consolidated to succeed the Hon. H. B. Rainville, resigned. Mr. Godin has been connected with Montreal Light, Heat & Power Consolidated since 1905 and was appointed secretary to Sir Herbert S. Holt, president, in 1916. While continuing officially in that position up to the present time Mr. Godin has, of late years, been actively identified with the financial structure of the company. He is an officer or director of a number of industrial and public utility companies, including the Canadian & Foreign Power Company, Hydro-Electric Bond & Share Company, British Columbia Power Company and Beauharnois Power Corporation.

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W. E. Dickerson of San Antonio Assigned Additional Duties

Walter E. Dickerson, director of the department of industrial development of the Central Power & Light Company, San Antonio, Tex., has been appointed assistant to the president of that company. A native of Cuero, Tex., and a graduate of Texas Agricultural and

Mechanical College in 1911, Mr. Dickerson affiliated himself with the State Fire Insurance Commission in Dallas in the engineering department. From 1912 to 1925 he practiced civil engineering, the latter year marking the date of his connection with the Central Power & Light Company.

In May, 1925, he became local manager at Victoria. Later, when Victoria became a district, Mr. Dickerson was made district manager. This position he filled until January 1, 1928. At that time the department of industrial development was created and Mr. Dickerson took charge of it. He will continue to direct the work of this department.

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J. H. Fortier of Quebec has been elected a director of the Shawinigan Water & Power Company to fill the vacancy created by the death of Hon. J. L. Perron. Mr. Fortier is prominent in the industrial and financial life of the province.

OBITUARY

Herr Ing. Heinrich Weiss, a director of the Elin Electrical Company of Vienna and a leading Austrian authority on high-tension installations and their protection, died recently in that city.

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Oscar F. McJunkin, formerly general inspector for the Ohio State Public Utilities Commission, Columbus, Ohio, died at his home in that city January 14, following an illness of over a year. Mr. McJunkin was employed by the Ohio commission for 30 years. He was 70 years of age.

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David W. Hennessy, superintendent of the Ohio Power Company and general manager of the Ohio River Electric Railway & Power Company of Pomeroy, died recently at his home in Portsmouth, Ohio. Mr. Hennessy had been connected with the Ohio River Electric Railway & Power Company since 1913. He began work for that organization under the general manager and in 1919, when a receiver was appointed, Mr. Hennessy became manager under the receivership. When the receivership was lifted, in 1924, he was made general manager, a position he held at the time of his death.

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Marcus A. Curran, formerly vice-president and general manager Bryant Electric Company, Bridgeport, Conn., died February 4 in Havana, Cuba, where he had been spending a vacation. Mr. Curran is widely known in electrical manufacturing circles, having been identified with various phases of this branch of the industry for almost 30 years. He was first employed by the National Conduit & Cable Company, but after a few years engaged in the general building and contracting business in New York City. Mr. Curran then obtained extensive experience with the Western Electric Company in the credit department of the Buffalo, Chicago, Indianapolis, Milwaukee and Minneapolis offices and as general credit manager of the company with headquarters in New York. Appointments followed to the positions of manager of the line material department, on the general staff, as assistant manager of the Philadelphia office, manager of the Omaha and Cincinnati offices and as general staff manager of the central-station department. Almost immediately after the formation of the Graybar Electric Company he was made assistant to vice-president of that organization, a position he relinquished to become vice-president and general manager of the Bryant Electric Company in 1927. He devoted considerable attention to association work.

Financial and Statistical News

SUDDEN renewed buying early this week boosted security prices to new high levels for the movement. Brokers attribute the steady accumulation to certain large investors who have been stepping into the market either for trading purposes or for permanent investment and to panic among the shorts. Utility common stock prices shared the advance, especially operating company stocks. The average of fourteen representative operating stocks is up four points from last week to 119.

——BUDGET ANNOUNCEMENTS OF THE UTILITIES continue to indicate that the amount of money to be spent in 1931 for new construction and improvements will be close to the 1930 totals. Increases are announced in many cases.

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British Current Generation Up

THE OFFICIAL RETURNS rendered to the British Electricity Commissioners show that 1,035,000,000 kw.-hr. was generated by authorized undertakings in the United Kingdom during November, as compared with 1,005,000,000 kw.-hr. in the corresponding month of 1929, or an increase of nearly 3 per cent. During the eleven months of 1930 up to the end of November the total amount of current generated by authorized undertakers was 9,719,000,000 kw.-hr., as compared with 9,245,000,000 kw.-hr. for the corresponding period of 1929, representing an increase of over 5 per cent.

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Employee Ownership in National Public Service

SIX SUBSIDIARIES OF THE National Public Service Corporation now have 100 per cent employee ownership of preferred stock, it is announced by Harry Reid, president. During the past year eight subsidiary operating companies have been offering their preferred stock to employees, Mr. Reid stated. In addition to the six companies with complete employee ownership, one company now has 98.5 per cent of its employees listed as stockholders and the other 81.5 per cent. Of a total of 3,600 employees, 94 per cent are now investors in their own companies.

For the National group as a whole, including subsidiaries of both National Public Service Corporation and National Electric Power Company, employee participation now stands at 85 per cent. This figure covers fourteen of the largest operating companies in the group, with 5,936 employee stockholders out of a total of 7,005 regular employees. "Within the past year," Mr. Reid said, "ownership of preferred stocks by employees in the National group increased from 51 to 85 per cent. We are already beginning to observe gratifying results from this increase in employee participation. In addition to the financial benefits which accrue to the employees, the companies are also benefiting from increased employee interest and co-operation."

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New Peak in New York

REPORTS OF NEW RECORDS made during 1930 continue to come in. The generating station net output of electrical energy of the New York Edison System of companies in 1930 was 6½ per cent greater than the output for 1929, Matthew S. Sloan, president of the company, has announced.

The 1930 output amounted to 4,983,507,819 kw.-hr., which was 304,795,921 kw.-hr. greater than in 1929. Also the instantaneous peak load, 1,247,800 kw. at 5 p.m., December 23, was 1.8 per cent greater than the peak in 1929.

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$100,000,000 More in Budgets

BUDGETS calling for the expenditure of more than $100,000,000 have been announced within the last two weeks. The majority of these exceed corresponding totals for 1930.

Midland United Company, for example, will spend $22,000,000, according to an announcement made by Samuel Insull, Jr., recently. Approximately $3,000,000 will be spent in completion of the electric generating station of the Northern Indiana Public Service Company at Michigan City and approximately $1,000,000 for new passenger cars for the Indiana Railroad system, which will enable the company to render improved service on the interurban railways in central and southern Indiana. Important additions will be made to the electric transmission systems of Midland electric light and power subsidiaries, and betterments will be made to electric and gas facilities wherever necessary.

National Electric Power Company will spend an estimated total of $24,445,000, as already announced. This total will be divided up in the following way:

	South Atlantic States	Middle Atlantic States	New England States	Total
Projects started during 1930	$2,067,930	$1,168,073	$2,457,897	$5,693,900
Projects to be authorized in 1931	3,876,155	8,313,911	6,561,370	18,751,436
Total estimated 1931	$5,944,085	$9,481,984	$9,019,267	$24,445,336

Los Angeles Gas & Electric Corporation has adopted a budget of approximately $4,000,000 for additions and betterments to its gas and electric systems during 1931, according to Addison B. Day, president and general manager. The greater part of the budget will be expended for additional gas and electric distribution facilities to meet increased demands for service. The balance will be spent for miscellaneous additions and improvements.

It is estimated that expenditures aggregating $15,000,000 will be required by North American Light & Power Company for new construction, extensions and improvements during 1931 and the board of directors will shortly be requested to authorize a construction budget of this amount. This figure is less than that of the 1930 budget primarily because of the lessened requirements on large developmental projects upon which the major portion of the construction work has been completed or is nearing completion. The larger portion of the contemplated expenditures for 1931 will be made to extend and improve the electric, gas, railroad

and miscellaneous properties to keep pace with the natural growth of demand for service and more adequately to provide and safeguard the quality of service.

Other budgets recently announced include: San Joaquin Light & Power Corporation, $13,234,000; Connecticut Light & Power Company, $4,614,000; Georgia Power Company, $21,000,000, and Alabama Power Company, $10,000,000.

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Canada's Energy Production at 1929 Level

ENERGY OUTPUT of central electric stations in Canada in December was slightly greater than a year ago, it appears from a report by the Dominion Bureau of Statistics. Figures for 1928 were exceeded by 7 per cent. From August to November, inclusive, the monthly output in 1930 was less than in 1929; December marks a change.

Canada's more favorable showing, compared with the United States, is due largely to gains in the Maritime Provinces, where the output in 1930 was more than twice as great as in 1929. In Quebec the output during

Canadian Output
(Thousands of Kw.-Hr.)

	1930	1929	1928
October	1,561,627	1,594,283	1,460,448
November	1,499,419	1,601,726	1,441,520
December	1,541,918	1,535,332	1,440,929

autumn was less than a year ago, though in December slightly greater, and in Ontario the final month of 1930 was down nearly 7 per cent, which, however, is better than the November figure. Nearly half of the Dominion's total production is in the one province of Quebec; about a third is produced in Ontario.

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Recent Listings

The Baltimore Stock Exchange has authorized the listing of two-year 6 per cent convertible secured gold notes of the East Coast Utilities Company, amounting to $900,000.

The governing committee of the Chicago Stock Exchange has confirmed the listing of secured gold debentures, 5 per cent series, of the National Public Service Corporation to the amount of $20,000,000.

The New York Stock Exchange has authorized the listing of 4,794 additional shares of common stock (par $15 per share) of the Federal Light & Traction Company, on official notice of issuance as a stock dividend, making the total amount applied for 484,777 shares. The New York Exchange has also authorized the listing of 166,760 additional shares of common stock (no par value) of the United Gas Improvement Company on official notice of issuance for securities of other companies, making the total amount applied for including this issue 23,314,577 shares of common stock.

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NEWS BRIEFS

An issue of ten thousand shares of preferred stock of the Nebraska Power Company was sold within a day by the employees of the company. The stock, which pays 6 per cent, sold for $101. The money derived from its sale is for improvements and additions and for the building of transmission lines to bring greater and better service to the rural communities.

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Stockholders of the American Gas & Electric Company will vote February 17 on increasing the authorized common shares to 8,000,000 from 4,000,000, all no par.

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A proposal to increase the authorized no-par common stock of the Public Service Company of Northern Illinois will be voted upon February 24 by the stockholders. The increase of from 500,000 shares to 700,000 shares is being made in order to provide for future financing for extensions and improvements. No immediate use of any of the additional stock is contemplated.

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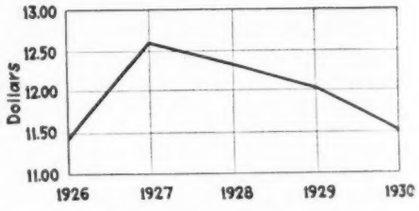
Chicago System Shows Gain Despite Depression

IMPORTANT facts in the 1930 annual report of the Commonwealth Edison Company of Chicago are:

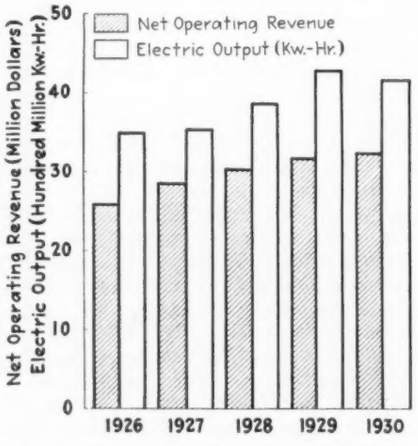
Gross operating revenue for the fiscal year ended December 31, 1930, was $84,004,438, as compared to a gross operating revenue of $83,486,744 for 1929, an increase of 0.6 per cent.

Net operating revenue was $32,647,724 for 1930, as compared to a net operating revenue of $31,805,690 for 1929, an advance of 2.6 per cent.

Earnings per share on fully paid capital stock amounted to $11.51 for 1930, as compared to $12.05 for 1929. The 164th consecutive quarterly dividend was paid, the current rate being $8 per share per annum.



Earnings per share



Commonwealth Edison output and revenue since 1926

Total electric output of power produced and purchased for use of customers was 4,191,296,000 kw.-hr. for 1930, as compared to 4,276,181,000 kw.-hr. in 1929, a decline of almost 2 per cent.

The authorized capital stock at the end of 1930 was $200,000,000, against $150,000,000 a year previous. Capital operations during the year included the issue of new stock of a par value of $14,251,000, authorized October 13, and the issue and sale of $12,000,000 of 4½ per cent first mortgage gold bonds, series E. Expenditures for extensions and improvements amounted to the sum of $20,498,441.

It is significant that increased efficiency in generation of current effected in 1930 represents a saving of 250,000 tons of coal a year.

The average use per residential customer was 695 kw.-hr. in 1930, as compared to 629 kw.-hr. in 1929. The maximum load carried at any one time was 969,800 kw. for 1929 (November 26), as compared to 1,000,200 kw. for 1929 (December 18).

Total generating and storage battery capacity, including allotments of capacity definitely assigned to the company in interconnected generating stations, was 1,322,000 kw. on December 31, 1930, as compared to 1,292,000 kw. on December 31, 1929.

Industrial Activity Rises 1 per Cent

A RISE of 1 per cent from the December level is indicated by January returns received in the ELECTRICAL WORLD's monthly survey of industrial activity based on energy consumption in manufacturing establishments. This improvement from the low point reached in the preceding month, advancing the index from 99.1 to 100.1, constitutes a partial recovery toward the November level (index 105.4) and brings it within 2 per cent of the October figure. But it shows that factory operation continues about 18 per cent lower than a year ago.

Important gains are noted, however, in the food industry, which underwent a decided decline in December and now shows a recovery, bringing it close to the November level; in fact, taking into account the usual winter sag, the industry was relatively more active in January than in November.

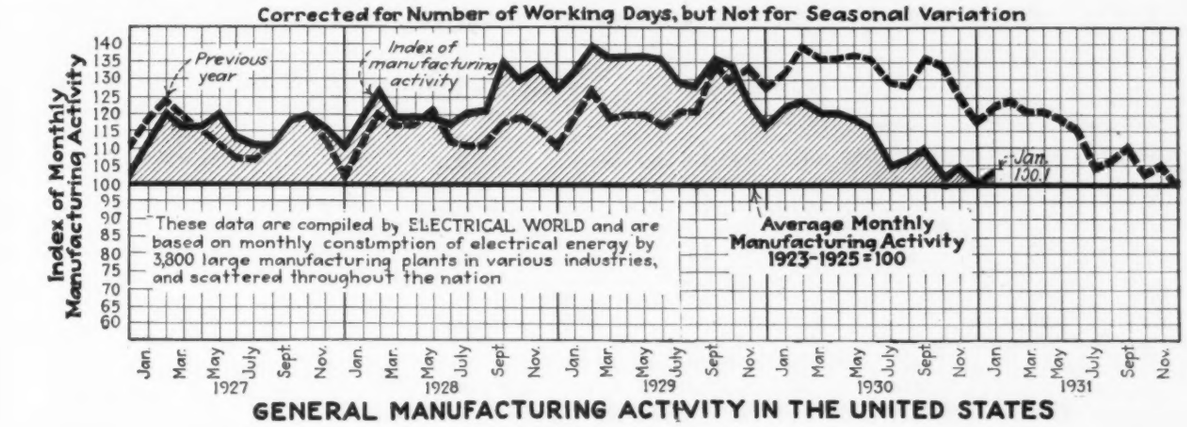
The 26.3 per cent increase in rubber brings that industry well above the level of each of the last seven months of 1930 except August and September. The normal seasonal rise was much exceeded, but the industry failed by a wide margin to approach the operations of January, 1930, which seem to have been but slightly affected by the decline that had already made itself felt in other lines. The upward movement was much greater than in the closely related automobile industry, which climbed 1.9 per cent from December, and also continues below 1930 operations.

Upward movements are indicated also in lumber, shipbuilding, leather and chemicals, while decreases appear in the metals group, in pulp and paper, in stone, clay and glass (1.3 per cent) and in textiles (3.8 per cent). The last-named began a recovery in November, and the index for January is higher than in any of the summer and fall months from July to October inclusive.

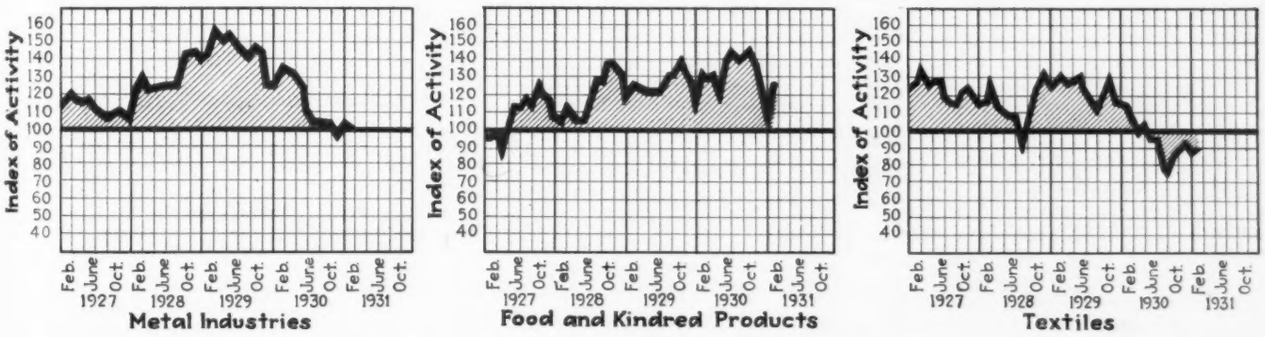
Current Manufacturing Compared with Other Periods

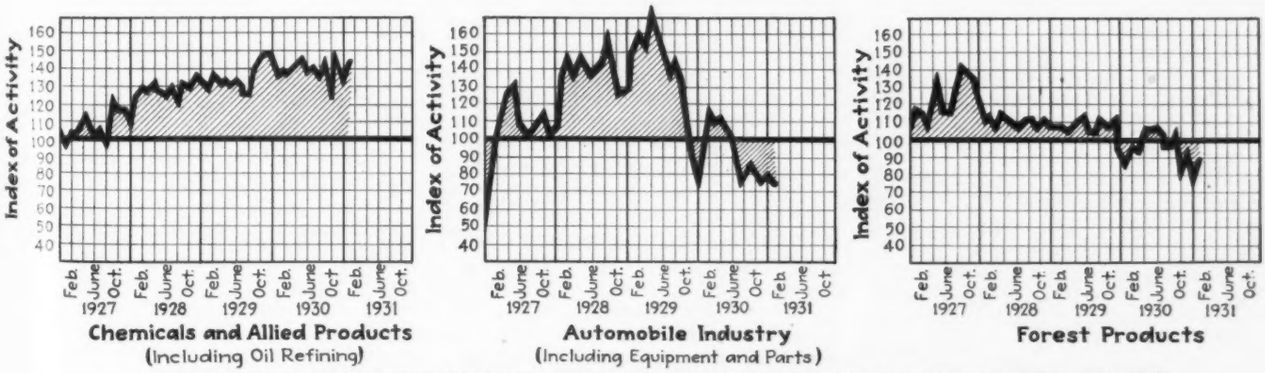
(Per Cent Change)

Industrial Group	Jan., 1931 and Dec., 1930	Jan., 1931 and Jan., 1930
All industry	+1.0	—17.7
Chemical products (including oil refining)	+2.6	+0.1
Food products	+12.2	—19.0
Iron and steel	—4.4	—26.4
Metal working	—5.0	—26.6
Leather products	+6.8	—20.4
Forest products	+15.0	—3.8
Paper and pulp	—11.5	—17.8
Rubber products	+26.3	—28.8
Shipbuilding	+40.2	+11.6
Stone, clay and glass	—1.3	—20.1
Textiles	—3.8	—23.1
Automobiles (including parts and accessories)	+1.9	—26.9


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
Jan. 100.1
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1927
1928
1929
1930
1931

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES





ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

Swope Urges Stabilizing of Employment

A MEANS TO INSURE the stabilization of employment is one of the world's greatest needs, Gerard Swope, president of the General Electric Company, said in an address January 26 to members of the Los Angeles, Calif., Electric Club.

"One of the real problems confronting society and industry is the stabilization of employment," Mr. Swope said. "It is not enough to alleviate unemployment when it comes. Something must be done to prevent it. It is not the problem of industry alone. It is a problem of society as a whole, and of industry.

"From industry's standpoint it is necessary for the reason, if for no other, that the workman may have the peace of mind necessary for him to do good work and get enjoyment out of it. This peace of mind as well as his other assets are necessary to society.

"Never in my experience has there been a time of unemployment when there existed as there does now so aroused a public sentiment not only to alleviate the misfortunes of unemployment, but to get something done that shall prevent its recurrence.

"What a tremendous contribution America would make to the world if it could lead the way to the solution of this problem.

"To make this world an easier and pleasanter place in which to live," Mr. Swope added, "is one of the things that the electrical industry is trying to do." He spoke of the elimination of much of the drudgery from woman's life through the use of electric appliances, the improvement of safety of flying by use of the radio beacon and other contributions of electricity to the varied activities of life today.

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Anaconda Making Cable for Osage River Project

ANACONDA WIRE & CABLE COMPANY is working on a contract for 3,250,000 lb. of 19-strand, 250,000-circ.mil, concentric-lay, hard-drawn copper cable for the Union Electric Light & Power Company in connection with its hydro-electric power development now under way on the Osage River. This amounts to about 800 miles of cable to be made up in accordance with A.S.T.M. specifications B1-27 and B8-27.

Anaconda is also providing 600 seamless cable connectors for this cable and is furnishing six draw benches for the installation.

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Employment Bureau for Engineers and Executives

AN EMPLOYMENT BUREAU, operated without charge, to serve as a clearing house for men particularly of the white-collar class, has recently been established by the American Trade Association Executives. The National Engineering Societies have had a similar organization for some years. Those in need of executives are advised to communicate with the American Trade Association Executives at 45 East Seventeenth Street, New York, and those requiring professional engineers or technicians should address Walter V. Brown, Engineering Societies Building, 31 West 39th Street, New York.

Raises Budget to Maintain Employment

By R. H. BALLARD
President Southern California Edison Company

WE ADDED an item of $8,000,000 to our normal construction budget of $20,000,000 for 1931 to assure uninterrupted work for our 5,100 employees. Work is being started on many jobs that might have been deferred for a year or two. This not only gives employment to other people, but enables us to take advantage of present low prices for materials. Far-sighted men generally are beginning to understand this philosophy, with the result that we will see considerable new construction of all sorts get under way this spring. Thinking people do not want a too rapid resumption of business with the unpleasant by-products of every boom. However, a steady improvement, such as now seems to be under way, will be most welcome to all.

Heating Appliance Section Appoints Director

AT A MEETING of the heating appliance section, N.E.M.A., held in New York January 21, A. D. Byler, Edison General Electric Appliance Company, was elected chairman; H. J. Mauger, Edison General Electric Appliance Company, vice-chairman, and J. S. Kennedy, Landers, Frary & Clark, treasurer.

In order to promote the interests of heating device manufacturers, Leon H. Curtice, formerly managing director of the National Gas Appliance Manufacturers' Association, was appointed director of sectional activities, to which position he has also been appointed for the electric range and electric water heating sections of the association. He will devote his entire time to trade extension work for these sections.

Adequate wiring of homes was one subject discussed at the section meeting. The chairman was authorized to appoint a committee to co-operate with other branches of the industry to promote the idea of adequate wiring, sufficient number of outlets, convenient location of outlets and proper distribution of outlets on different branch circuits.

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C.I.T. Net Profits Down 8 per Cent

WITH THE SINGLE EXCEPTION of the banner year 1929, gross business and earnings of Commercial Investment Trust Corporation for the twelve months ended December 31, 1930, were the largest in its history. Net volume of bills and accounts purchased during the year totaled $329,044,170, compared with $489,544,018 in 1929 and $282,163,896 in 1928. Consolidated net profits available for dividends amounted to $8,318,793, compared with $9,132,610 for the year 1929 and $5,278,262 for 1928. President Henry Ittleson's report given to stockholders says:

"The experience of 1930 confirms our faith in the fundamental soundness and safety of installment paper. While repossessions and charge-off items arising out of installment paper acquired by us have been somewhat greater than usual in proportion to volume of business, they have not been disturbing at any time. Repossessed automobiles in our possession at December 31, 1930,

amounted to $231,417 at realizable values, and other repossessed products are negligible in amount."

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Allis-Chalmers Bookings Down 14 per Cent

THE PRELIMINARY REPORT of the Allis-Chalmers Manufacturing Company for the year 1930 shows a net profit of $3,604,609, equivalent to $2.86 per share on the 1,258,400 shares of no-par common stock outstanding. This compares with $4,330,888 for the year 1929 or $3.44 on similar per share basis, a decrease of less than 17 per cent. In 1928 the net profit was $2,933,909.

Bookings for the year amounted to $41,606,196, contrasted with $48,493,817 in 1929, a decrease of about 14 per cent. Unfilled orders December 31, 1930, after annual revision, recorded a slight gain, aggregating $13,002,923, as against $12,872,676 at the close of 1929.

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TRADE BRIEFS

Link-Belt Company, Inc., for the year ended December 31, reports net profits of $2,310,332, equal, after preferred dividends, to $2.89 a share on the common stock, compared with $3,484,686, or $4.54, in 1929.

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Net profits of Altorfer Brothers Company were $459,938 in 1930, compared with $454,176 in 1929, as shown by the annual statement. This equals $15.47 per share on 150,282 no-par value common after preference dividends.

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General Cable Corporation announces the appointment of Robert S. Hopkins as manager of the metropolitan district sales office.

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General Refractories Company announces the appointment of the West Allis Fuel & Supply Company of West Allis, Wis., as distributor of the company's products.

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Morison Electrical Supply Company reports for five months ended December 31 net earnings equal to 84 cents a share on the common stock outstanding. The balance sheet shows current assets of $1,223,034, against current liabilities of $442,380.

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Net shipments of Cutler-Hammer, Inc., for 1930 totaled $9,342,000, as compared with $12,370,000 for the previous year and $9,340,000 during 1928. Fourth quarter shipments amounted to $1,936,879, against $2,198,116 in the preceding quarter and $3,171,653 in the like 1929 quarter.

Energy Use Measures Production and Employment

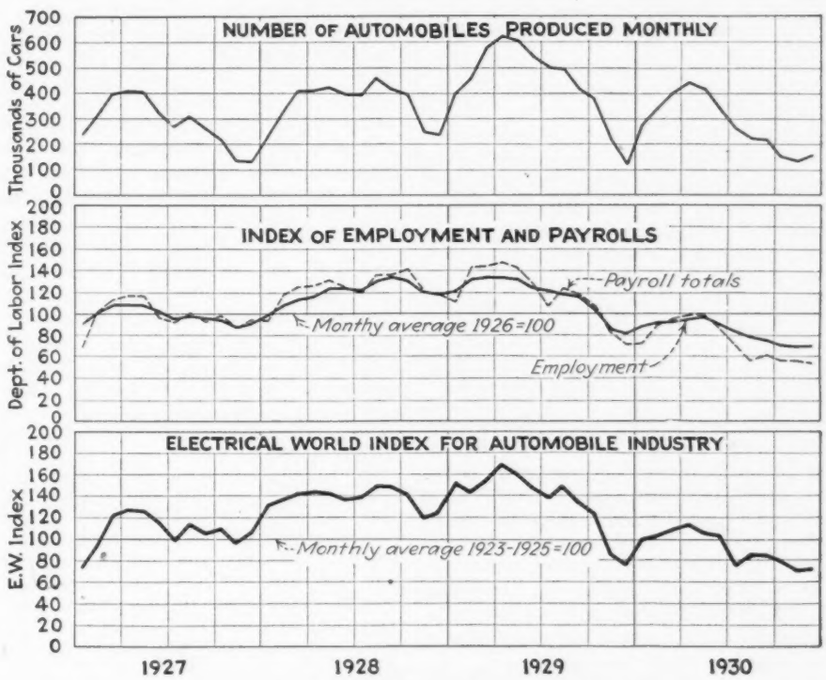
HOW do variations in electrical energy consumption compare with other gages of industrial activity? The answer concerns manufacturing industry in general, not merely central-station operation, for kilowatt-hour statistics can be given immediately at the end of each month and are currently collected for many individual mills and factories.

Qualitatively it is an accepted fact that energy sales and production move up and down together; quantitatively some lines lend themselves better than others to comparative examination. The automotive industry is in the former class. It is well defined, highly electrified and has several series of data by which its activities can be measured. Four such series are here charted.

The agreement between the curves for electrical energy consumption, for employment and total payrolls is seen to be particularly close; there is also a general agreement between these and the number of cars produced, but it is evident that the variation in monthly output of cars gives an exaggerated picture of the seasonal fluctuation in factory operation.

Thus the early winter minimum in cars is not reflected to nearly as great a degree in employment, wages and energy consumption. The automotive industry has found means for smoothing its operating cycle, presumably by concentrating on the production of parts, including those for export and foreign assembly, during the off season in car shipments.

In 1929, for example, the car output in the lowest month was only 25 per cent of that in the highest, but the energy use was 45 per cent, payroll 48 per cent and employment as measured by number of employees 60 per cent. It may be assumed that some of the latter were on part time. The two figures that are closest together are energy and payrolls, both sensitive indicators of man-hours of employment.



Measures of activity and output in the automotive industry

The data used here are: (1) Number of cars produced, as given by the National Automobile Chamber of Commerce; (2) Bureau of Labor Statistics indices of employment and payrolls; (3) ELECTRICAL WORLD index of industrial activity based on reports of electrical energy consumed in plants manufacturing cars and accessories. For present purposes the usual adjustment for difference in length of month has been omitted, because production figures are also affected by this difference.

Market Conditions

BUSINESS on the Pacific Coast continues to improve very satisfactorily, with construction active and orders for equipment and accessories holding up well. New or additional lighting equipment is being ordered by several municipalities.

——DEMAND FOR PRIMARY AND AUXILIARY ELECTRICAL EQUIPMENT from government sources is prominent in Eastern business this week. New England reports considerable activity in small orders.

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PACIFIC COAST

—WHOLESALERS REPORT *fair business with an increase in unfilled orders that is encouraging, coupled with some big awards recently made and considerable construction now being figured.*

—MUNICIPAL AND POWER *company and government business is especially brisk.*

Major construction projects now under consideration include the $8,000,000 Long Beach station of 135,000 hp. capacity, with the expectation of several more similar units in the next few years; the 70,000-hp. Herndon steam station of the Pacific Gas & Electric Company, in the Fresno district; a $2,000,000 tire factory for the Oakland East Bay district, and the Chrysler plant, both of which are held pending the end of the automotive depression; $2,500,000 worth of post offices for interior cities, planned by the government for northern California; a $500,000 theater for Alameda; a $70,000 power plant increase for a lumber plant in Oregon, doubling its present capacity; a lime plant for Auburn; the $2,000,000 Portland post office and a new skyscraper hotel for Portland, both reflecting the fact that Portland showed the smallest percentage of increase of 1930 over 1929 business of all the larger coast cities, and a $700,000 warehouse for Los Angeles.

The market shows such special trends as maintenance and renewal business for various packing and canning plants, also for summer resorts, some of which, such as Arrowhead Springs, in southern California, are planning extensive expansion. Many street-lighting jobs are reported, such as $15,000 for Eureka and a $20,000 award for Los Angeles, and there is much building activity in the interior cities, such as a $250,000 hospital for Colusa, a $500,000 theater for Sacramento, and the like. The outstanding award for the past week covers $28,000 for the San Francisco Hospital, including wiring and fixture installations, radio paging and call system. Considerable Hawaiian Island business is reported for power machinery, and wiring materials at the Schofield Barracks job, of which the latest unit, covering an $80,000 appropriation for new quarters, is encouraging.

Bidding $737,155, a sum $175,806 less than the only other bidder, the Aluminum Company of America for the second time on February 5 submitted the lower offer to the Seattle Board of Public Works for furnishing 736 miles of transmission conductor for the projected line between the South substation in Seattle to the Diablo hydro-electric development. The other bid was submitted by the Anaconda Wire & Cable Company. Early action looking toward the award of the contract is expected to be taken by the board. In connection with this improvement, bids will be called shortly by the board for fabricating and erecting steel towers to carry the line, estimated to cost $500,000. Motor and apparatus sales last week reached rock bottom, the only movement reported including fifteen small motors, from 10 hp. down, to dealers, a few to eastern Washington orchards and irrigation projects and fifteen machines from 25 hp. down to a mill which is being converted from steam to electric drive. Reported specifications are being written for motors and control for a 150-ton sulphite pulp mill to be built by the Weyerhaeuser interests at Longview at an estimated cost of $3,500,000 and bids will be taken within the next 60 days.

CONSTRUCTION PROJECTS

Southern Sierras Power Company, Riverside, Calif., plans power substation at Las Vegas, Nev., for Hoover Dam project, to cost $250,000. Edison Electric Appliance Company, Ontario, Calif., will proceed with plant addition to cost over $200,000. Auburn Chemical Lime Company, Auburn, Calif., plans plant to cost over $85,000. Alameda, Calif., contemplates ornamental lighting system with underground conduits, to cost $83,000. Willamette Valley Lumber Company, Dallas, Ore., plans addition to electric power plant to cost $75,000. Crown Willamette Paper Company, Camas, Wash., contemplates addition to mill to cost over $400,000. Bureau of Reclamation, Denver, Colo., will receive bids until February 25 for a recarbonization plant, agitator units, clarifier units, etc. (Specification 505-D). Denver, Colo., plans hangar at municipal airport to cost $75,000.

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NEW ENGLAND

—LITTLE CHANGE IS REPORTED *in steady buying of small lot orders reported recently, except that more activity is noted for fractional-size motors and machine tool makers are more active.*

Recently orders for motors noted by one prominent manufacturer included a lot of 100 and another for 130; in addition appliance equipment manufacturers are more active in this district. Recently an order for fractional-horsepower motors was received, which is more encouraging than the trend for the past month.

Activity in motors for pumping is noted. Change in one city's plans indicate the purchase soon of extensive electrical pumping apparatus. Heavy equipment interest is limited to a few orders pending. Scheduled materials are confined to wiring contracts for a number of large alteration projects and intercommunication requirements.

CONSTRUCTION PROJECTS

Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until February 24 for one electric generator for Portsmouth, N. H., navy yard (Schedule 5067). Board of trustees, Boston City Hospital, Boston, Mass., plans expansion and improvement program at institution to cost $813,000, including new electrical distributing center, installation of refrigerating equipment and system, etc.

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MIDDLE WEST

—GENERAL BUSINESS *in the Middle West section continues to show improvement. The volume of business is gradually increasing and the prospects for a better business month in February seem a little more promising. Recent reports apparently indicate that the preceding month was somewhat better than indicated at its close.*

—INDUSTRIAL ACTIVITY, *while still quite spotty, is improving and a better feeling toward future business exists.*

The major activities continue to show improvement, with increases in production declared or anticipated in the steel and automotive industries. Railway equipment purchasing is being resumed

and a considerable amount of maintenance purchasing is going on. While the January production of electricity declined perceptibly, due to weather conditions, no changes in operating schedules are anticipated at the present time. Some of the interesting items placed this week include an order for Western red cedar poles to cost approximately $125,000, one 3,333-amp., 625-volt nominal rated rectifier unit, three 2,000-kva. oil-insulated, self-cooled, single-phase, 60-cycle, 12,000-volt transformers, one 300-kw., two-unit motor-generator set and one 57-cell operating bus battery.

CONSTRUCTION PROJECTS

Northern States Power Company, Eau Claire, Wis., plans ornamental lighting system at Chippewa Falls, Wis. Richland Center, Wis., will soon take bids for an ornamental lighting system. Northern Aircraft Corporation, Bay City, Mich., plans airport near Mount Morris, Mich., to cost close to $85,000. Hubbard Lake Resort Association, Hubbard Lake, Mich., contemplates transmission lines and distributing system for rural service for distance of 60 miles. Baraga County Light & Power Company, Baraga, Mich., will proceed with power dam on Sturgeon River for hydro-electric power project to cost over $350,000. Midland United Company, Chicago, Ill., has approved fund of $22,000,000 for expansion and improvements in power plants and systems in Indiana during 1931. John Carroll University, Cleveland, Ohio, will soon take bids for power plant and other buildings to cost close to $2,000,000. Central Iowa Power Company, Des Moines, Iowa, plans extensions in transmission lines in Dallas County.

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SOUTHEAST

—BUSINESS IN THIS SECTION *last week was slower than for several weeks past and even the volume of supply orders was off, such orders as received being a scattering of small purchases for current needs.*

—SOME LARGE ORDERS *in prospect failed to materialize and indications are that central stations will be slow about dipping into their 1931 budgets.*

A Georgia company will shortly place orders for induction voltage regulators aggregating $10,000. One company ordered last week bare and weatherproof copper amounting to $4,400 and distribution transformers totaling $3,100. Some other central-station orders were for creosoted pine poles amounting to $2,100, voltage regulators amounting to $2,300 and $1,400 worth of control cable.

CONSTRUCTION PROJECTS

Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until March 3 for motor-generator sets, switchboard control and distribution panels with instruments, for Norfolk, Va., navy yard (Schedule 5086). Wierton Steel Company, Wheeling, W. Va., will proceed with electrification of mill at Clarksburg, W. Va., to cost about $250,000. Tennessee-Eastman Corporation, Kingsport, Tenn., has plans for rayon mill to cost over $700,000.

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EASTERN

—GOVERNMENT ACCOUNT *is taking the lead in immediate requirements for primary and auxiliary electrical equipment and February closings will represent a sizable volume of sales.*

—CENTRAL-STATION ACCOUNT, *also, shows up better for the week and a closer indication of normal is shown by awards for substation and other service. Moreover, there are a number of large-sized contracts pending that should go to swell aggregate business at or near the close of the month.*

—INDUSTRIAL ACCOUNT EXHIBITS *its now-frequent tendencies of being spotty and commitments are appreciably short of indicated sales, or, in other words, sales are far behind the volume of inquiries because the latter are not maturing.*

A leading manufacturer of prime movers reports increased estimating on forthcoming sizable contracts and anticipates some satisfactory commitments within 30 to 60 days. A metropolitan central station has placed an order with a state manufacturer for transformers and accessory equipment to an amount of $60,000. A power company in West Virginia has given a contract to a New York maker for switchgear for a hydro-electric power project now under way, totaling $125,000. The Southern Sierras Power Company has purchased three 5,000-kva. power transformers and auxiliary equipment from the Westinghouse Electric & Manufacturing Company for installation at its San Bernardino substation, and will also secure four similar transformer units for another power substation, totaling more than $100,000. The Memphis Power & Light Company, Memphis, Tenn., is said to be in the market for a number of structural steel transmission towers for a high-tension crossing over the Mississippi River. A manufacturer of gas engine compressors is securing some record commitments through the activity in gas pipe line construction and just closed for a total of eleven 800-hp. units for a stated figure of $375 000.

Business continues fair in the line of electric motors and kindred heavy equipment. The Westinghouse company will furnish a unit of this kind to a lumber company in the West, and is also building a 6-ton electric locomotive for a coal-mining company in Kentucky. An order has been secured by Westinghouse for electrical equipment for ten of a total of fifteen new trolley buses for the Chicago Surface Lines, the buses to be of 40-passenger type, each weighing about 17,500 lb.

CONSTRUCTION PROJECTS

Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until February 25 for a turbo-alternator for the New York navy yard (Specification 6391). Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until March 3 for motor-generator sets, panels and spare parts for the Brooklyn, Philadelphia and other navy yards (Schedule 5087). Municipal Sanitation Department, New York, will receive bids until March 9 for initial section of sewage disposal plant on Ward's Island, to cost $6,600,000, entire project to cost $30,000,000. Essex County Vocational Schools, Newark, N. J., will receive bids until February 23 for electrical and mechanical supplies, as per specifications on file. Department of City Transit, Philadelphia, Pa., will receive bids until February 17 for changes and repairs in substation equipment for Broad Street subway. General Supply Committee, United States Government, Washington, D. C., will receive bids until March 4 for electrical supplies for next fiscal year, including fans, insulating materials, flashlights, wiring equipment, etc. (Class 6).

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SOUTHWEST

—CONDITIONS IN THE *St. Louis district still retain the favorable tone of the last two weeks. Of the large manufacturers interviewed all are optimistic on the probable volume of this year's business and say that medium-sized apparatus is moving very well, with prospects for some good business in the near future.*

Contracts which have been closed since last report include three synchronous motor-generator sets, two of 300 kw. and one of 150 kw., all for one of the newspaper buildings and costing $17,000. Another order was for relays for one of the distributing companies, to cost $12,000, and network potential devices to cost $6,000.

CONSTRUCTION PROJECTS

Monsanto Chemical Works, St. Louis, Mo., has authorized expansion program at different plants in 1931 to cost $2,200,000. Hudson & Dugger Company, Little Rock, Ark., plans barrel heading mill to cost about $75,000. East Texas Refining Company, Henderson, Tex., plans oil refining plant to cost over $100,000. War Department, Washington, D. C., is asking bids until March 5 for group of buildings at Barksdale airport, Shreveport, La., to cost about $100,000.

New Equipment Available

Load Test Set Has Clamping Transformer

A RECENTLY DEVELOPED LOAD test set with clamping transformer, especially designed to be used over either a cable, busbar or blade-of-knife switch, has been announced by the Electrical Engineering Sales Company, Los Angeles,

Calif. It may conveniently be used in a very limited space. The opening of the transformer is sufficiently large to inclose a cable 1¼ in. diameter or a busbar 2½ in. wide. This set consists of a Weston model 233 ammeter, together with an 8-ft. flexible "Tirex" cable, transformer and plug.

A plug and cartridge fuse is furnished, so measurements can be easily made on any circuit without having to cut into the line. The set has four ranges, running from 0-15, 0-60, 0-200 and 0-400 amp. Changing from one range to another is accomplished by pulling the ammeter plug, rotating it to the proper position and reinserting it.

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Toggle-Operated Time-Element Switch

AN ELECTRIC LIGHT or power switch containing a time element which will automatically turn off electric current has been announced by M. H. Rhodes, Inc., New Haven, Conn. The time element is operated by throwing the toggle the desired number of times. Each throw of the toggle is shown as intervals on the dial. The interval may be seconds, minutes or hours, depending upon the particular model. When ready to start time element, throw toggle to "off" position, as indicated on faceplate. When time has expired "mark time" will automatically cut off electric current.

By setting the small side lever to "off" position it can then be operated as a regular switch as the timing mechanism has been discontinued, cutting off the current. This lever can also be used to cut off current immediately, although the timing element may be operated.

▼

A NEW UTILITY RECEPTACLE OUTLET for the electric clock, etc., has been designed by the National Electric Products Corporation, Pittsburgh. It is an inexpensive device, complete with box and receptacle. It takes either armored cable or non-metallic sheathed cable and can be installed with necessary neatness and compactness in any desired location with a minimum amount of labor. The box angle back and angle connector avoid short radius bends and permit easy installation without cramping or forcing the cable into narrow apertures. A 15-amp., 125-volt, 10-amp., 250-volt super-Bakelite receptacle with face formed to provide automatic locating and centering of the rugged T-slot terminals is designed to assure a positive and permanent contact and trouble-proof outlet.

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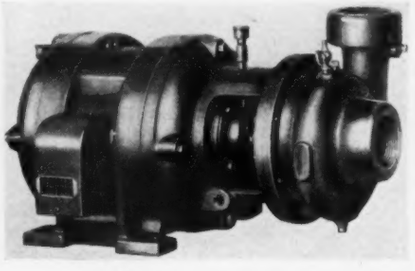
Inclosed Fan-Cooled Pump Motor Unit

AN EXTENSION TO COVER three new sizes in its line of "SSU" centrifugal pumping units of single-shaft, two-bearing design, which now includes ratings from 30 to 500 g.p.m. for heads under 100 ft., is announced by Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Recent adoption of total inclosure of motor housings on the pump end of these units and the use of totally inclosed fan-cooled motors, if necessary,



permits their use for severe service conditions.

"SSU" pumps are designed especially for heads heretofore not adequately covered by a low-price, guaranteed, high-grade pump. Some applications of the pumps are: Water supply, circulation of water, oil or brine for heating or cooling systems, for transfer of many liquids, air conditioning, bottle washing and other washing machinery, garden or lawn watering, etc.

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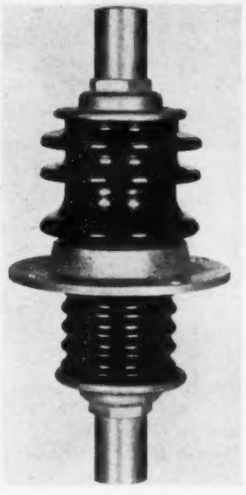
High Current Capacity Roof Bushings

A NEW LINE of high current capacity porcelain bushing roof entrances, a 2,000-amp., 7.5/15-kv. type, is announced by the Delta-Star Electric



Company. The bushing is compound filled at the factory and is free from corona inside the porcelain even when flashover potentials are applied. It is of wet process porcelain with graded petticoats, improving the wet flashover ratios. Above the roof the dry flashover is 80 kv. and the wet 55 kv. The portion below the roof has a dry flashover of 55 kv. The terminals on either end are machined to standard pipe size, making possible the use of standard I.P.S. connection fittings.

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A COMPLETE LINE OF BATCH TYPE NITRIDING FURNACES for use at temperatures up to 1,200 deg. F. has been announced by the General Electric Company. Included in the line are two sizes of vertical cylindrical type furnaces with a fan for circulating the ammonia gas and two sizes of box type furnaces, complete with charging trucks for handling the retorts. The vertical type furnaces consist of an outer shell containing the heating units of nickel-chromium resistor ribbon and an inner retort which is inserted into the furnace through a hole in the cover. The retort is made in two parts, the upper part containing the motor and fan and the lower part containing the charge to be nitrided.